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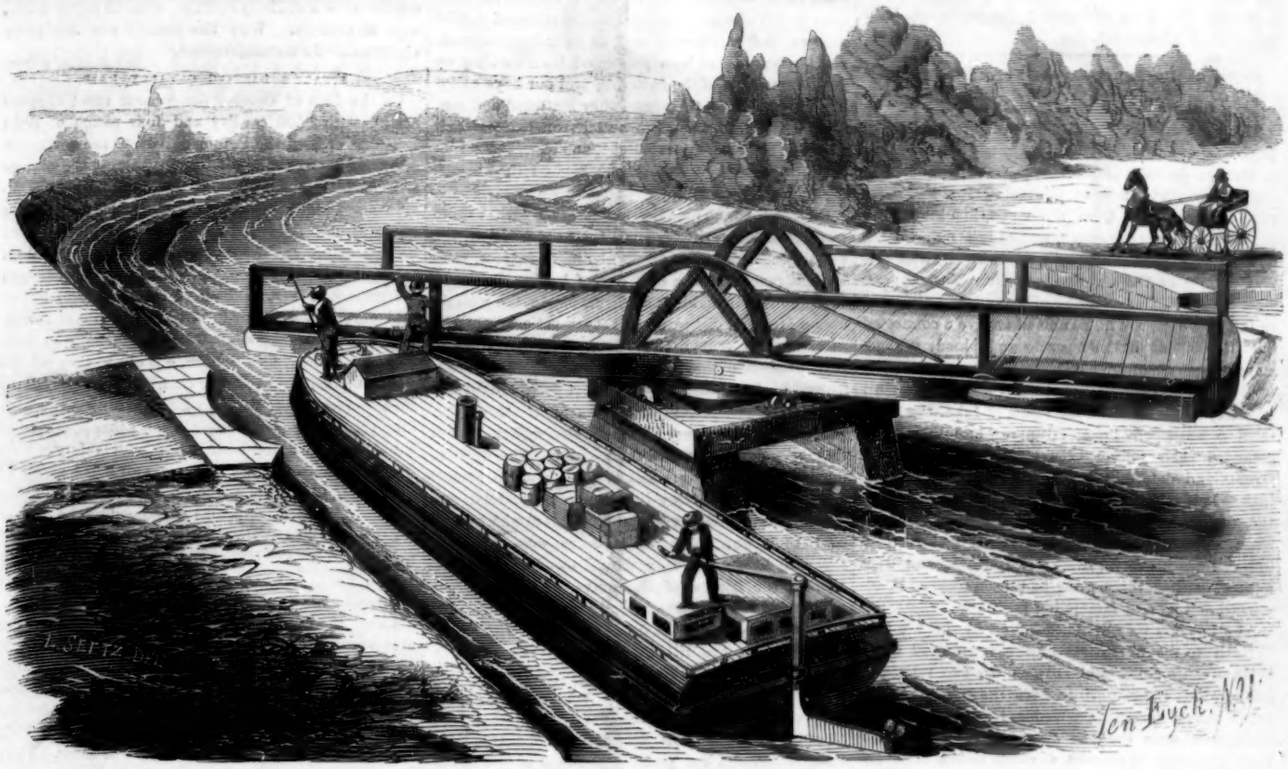


SELSER'S SELF-CLOSING BRIDGE.

Improved Self-Closing Bridge.

As canals can be crossed only on bridges, large numbers of these structures are required for the country roads, and for the use of the numerous farmers whose lands are cut by canals. To raise all of these bridges so high that the boats may pass under them, not only increases the cost to the canal company, but the steep ascent on each side is a serious obstruction to the passage of loaded teams over the bridges. Many efforts have consequently been made to devise a swinging bridge which might be built but little above the level of the water, and which would be opened by the boat in its passage, and would return, after the boat had passed, to its position in line with the road. None of these plans have come into use because they were too complicated, or were otherwise objectionable.

The bridge here illustrated is exceedingly simple in construction, and the inventor says that on practical trial it has been found to operate with perfect success.

The bridge as represented in the engraving is balanced on a central pier, so that it may swing horizontally upon a pivot, its support consisting of circular tracks running on rollers so arranged that as the bridge swings out of place to let a boat pass it rises a little, and then, after it has passed, the bridge returns to its proper position by the action of gravitation. The arrangement is plainly shown in the engravings.

Fig. 2

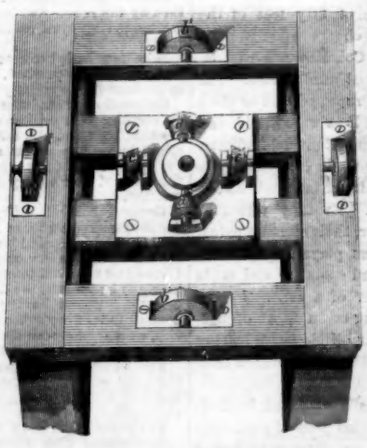


Fig. 3

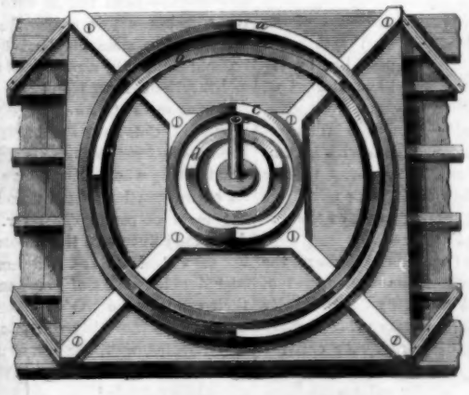


Fig. 1 is a perspective view of the bridge while being opened by a passing boat, Fig. 2 is a view of the upper part of the supporting pier with the bridge removed, and Fig. 3 is a view of the central portion of the bridge turned over so as to show the under side.

The outer ring, *a*, Fig. 3, rests upon the two rollers, *a' a'*, Fig. 2. The under surface of this ring is formed in four inclined planes, so that as the bridge is turned upon its center, it will be slightly raised by the inclined surface of the ring running upon the stationary rollers, and will consequently be brought back after the boat has passed, to its proper position in line with the road. The ring, *b*, rests in like manner upon the rollers, *b' b'*, and as these are placed at right angles with the rollers, *a' a'*, it is neces-

sary to have the inclinations of the ring, *b*, turned a quarter of a circle from those of the ring, *a*. Near the center are two other rings, *c* and *d*, running respectively on pairs of rollers, *c' c'* and *d' d'*; four rings being provided in order to distribute the support over a sufficient surface.

Upon the sides of the bridge where the bow of the boat will strike, elastic arms, E E, or springs are provided to prevent a shock.

Where the topography renders it desirable, the bridge may be made of only one wing, with the pier on one side of the canal; in this case the bridge will be balanced by weights on its shorter end.

This bridge may be used as a draw on rivers as well as canals; thus dispensing with any attendant, and securing the closing of the draw after the passage of a vessel with absolute certainty.

The patent for this invention was granted October 29, 1861, and further information in relation to it may be obtained by addressing the inventor, John Selser, at Williamsport, Pa.

NOTES ON NAVAL AND MILITARY AFFAIRS.

THE BATTLE OF CORINTH.

The most terrific fighting of the war took place at the battle of Corinth, the results of which were given in General Grant's dispatches, published in our last week's account. But as General Grant was more than 50 miles away from the scene, his knowledge of the affair was imperfect, and as full descriptions of the battle have since been published by able correspondents of the Chicago and New York papers, who were at Corinth, and by officers who participated in the battle, we are now enabled to give a connected narrative of this most desperate and bloody engagement.

After General Rosecrans returned from the pursuit of Price, which followed the battle of Iuka, the three rebel commanders Price, Villipigue and Van Dorn, collected their forces, between 20,000 and 30,000 strong, and determined to make an attack on Corinth. It is said that this design was concealed from the privates, and it is also said that the rebel generals had learned that the heavy siege guns had been removed from the fortifications of Corinth, and were not aware that these guns had been planted in advanced and more commanding positions.

At all events they marched round by the south of Corinth to the northwest of the town, and made their advance along and between the two railroads, one of which enters Corinth from the north, and the other from the west. On Wednesday, October 1, two companies were sent to cut the railroad coming from the north to prevent General Grant from dispatching reinforcements to Corinth, and from the time till Friday, the 3d, continual skirmishing was going on between our forces who were stationed beyond our fortifications, and the advance of the rebel army. On Friday a pretty severe fight occurred, the enemy attacking in force, and our advanced troops endeavoring to maintain their positions; they were driven back, however, with the loss of several cannon.

Before daybreak on Saturday morning our heavy siege guns opened on the advanced batteries of the enemy, which had been boldly planted within 500 yards of our forts. The enemy replied, but by six o'clock our superior weight of metal had silenced all of the enemy's guns, a portion of which were withdrawn and the others abandoned. Our soldiers advanced and seized the abandoned guns with a number of caissons. Then occurred the most terrible change that has taken place during this war. We give the description in the stirring words of the correspondent of the Chicago *Tribune*:—

At this time, as we learn from rebel prisoners, the rebel soldiers were gathered in the timber, out of range of the guns, and addressed by General Price and others upon the necessity of capturing Battery Robinett, whose murderous discharges were creating such havoc in their ranks, and alone prevented the capture of the town, and called for volunteers to attempt its capture. He represented the perilous nature of the undertaking, and demanded to know if 2,000 men, led by a general officer, were willing to undertake its capture. General Rogers promptly offered to lead the forlorn hope, and 2,000 men instantaneously stepped from the ranks. At 10 A. M. the enemy were discovered drawn up in two lines, near the timber between the Mobile and Ohio railroad, one facing the town, the other the batteries, each at right angles to the other. The one destined for the town was drawn up just behind Halleck's old headquarters. At a given signal they moved forward rapidly under a heavy fire of grape and canister from our artillery in front and the battery to the left, followed at supporting distance by their reserves.

During their advance their colors were shot away several times and as often replaced. They crossed with difficulty the abattis of trees just outside of the town, and gaining a position where there were no obstructions, they came gallantly forward at a charge, sweeping everything before them. They occupied the streets of Corinth, and their line of battle was formed just in front of the office of the provost marshal. Meantime our batteries were playing upon them with excellent effect. A huge shell from battery "Williams" exploded in the midst of a solid column, and thirty were sent to their long account. Their reserves had been prevented from coming up by the attention of the batteries, and our boys rallying, charged upon them, and they scattered and ran, many of them being shot and bayoneted in their tracks. They were put to flight, and in great disorder reached the edge of the timber beyond the abattis, from which they started.

By this time the first line and reserves—what there was left of them—had reached their old position, the second line forming an angle of ninety degrees, were well advanced in the direction of battery Robinett. Disappointed in gaining a lodgement in the village, discomfited and disheartened they must confess to an utter rout if that battery be not taken. Once in their possession the town is theirs. The 2,000 men massed in single column, eight feet deep, moved forward in silence, General Rogers at the head, regardless of the shower of bullets which whistled about their ears and decimated their ranks. The decisive moment, the turning point of the engagement had arrived. Every battery bearing on the column was double charged with grape and canister, which burst over their devoted heads. Scores were killed at every discharge, but they moved steadily on, maintaining the silence of the grave. As fast as one soldier fell his comrade behind stepped forward and took his place. They charged up to the battery, reserving their fire till they reached the parapets. Twice repulsed, the third time they reached the outer works and planted their flag upon the escarpment. It was shot down and again planted, but shot down again. They fired from the parapet and through the embrasures, and had partial possession of the works. But their triumph was of short duration. According to previous instructions the gunners fell back behind the works, and battery Williams and battery Robinett threw a murderous fire. I was at short range and the missiles were directed with fearful accuracy. No body of men could stand that fire, and they reluctantly withdrew. This charge upon the battery was a magnificent but foolhardy affair.

The intensity of the fight may be judged from the fact that 260 dead bodies were found in and about the trenches within a distance of fifty feet of the works. Then came a splendid charge upon the disordered column by a portion of Col. Mower's brigade, and they were routed and almost annihilated. The attack upon the fort was twice repeated and as often repulsed. Col. Rogers and Col. Ross were killed, and several other well-known and important field officers. The fighting where Col. Mower made his charge was for a great portion of the time hand to hand, and of the most desperate character. As they retreated down the hill toward the timber, their starting point, batteries Robinett and Williams played upon them with double charges of grape and canister, and made their retreat take the character of a rout. In the meantime skirmishing was going on in front of battery Phillips, resulting in a sharp little fight, lasting fifteen or twenty minutes, at the end of which time the rebels retreated.

Beaten at every point, and disappointed in their well-conceived and nearly-executed plan of capturing Corinth, a general movement, as if retreating, was plainly perceptible along the entire rebel line. This was about 12½ on Saturday, and virtually the end of the engagement here. Our troops stood in line in readiness to receive them at every point should they desire to renew the attack. It was thought that an attempt would be made to mass the rebel troops at some other point, but this expectation was not destined to be realized. The enemy slowly took up his line of retreat in the direction of Chervalla.

The enemy retreated to the northwest, but the next day (Sunday the 5th) they were met by General Hurlburt, who, by order of General Grant, was advancing from that direction, and who attacked them with fury, driving them back three miles towards Corinth. Here they were encountered by General Rosecrans, who was advancing in pursuit, and thus placed between two armies, it is said that the shattered troops of the enemy plunged into the morasses and fled to the South.

Rosecrans, Hurlburt and Ord retired with their forces, while McPherson alone continued the pursuit. He, however, followed but a few miles and at last accounts the remnant of the great rebel army of the southwest was at Holly Springs, some 50 miles southwest of Corinth. Why the pursuit was not more vigorous we do not understand.

STUART'S DASHING CAVALRY RAID.

On the 10th of October the famous rebel General Stuart, with 2,500 cavalry and four pieces of light artillery, crossed the Potomac river, to the northwest of our army, and marching rapidly across the narrow strip of Maryland, continued his course into Pennsylvania, as far as Chambersburgh, which is 16 miles north of the Maryland line. The force arrived at Chambersburgh at about seven o'clock in the evening.

During the night and in the morning they helped themselves to boots, shoes and clothing, which they said they much needed, out of warehouse stores, giving, in some instances, Confederate notes in payment. The next morning, at 8 o'clock, they set fire to all the buildings of the Cumberland Valley Railroad Company, which were mostly consumed, with four second-class engines—all the other engines of the Company having been run off for safety. Two warehouses, containing military stores belonging to the State, and placed there on the occasion of the former rebel raid, were also consumed. The loss of the Cumberland Valley Railroad Company is not much short of $40,000. The Government property lost is worth not over $2,000. It was the remnant of supplies for the troops.

They then marched to the southeast, sweeping around our army and pushing for the Potomac which they reached at Nolan's Ferry, on the 12th. Here were several regiments of Union infantry who prevented the passage, and the rebel cavalry broke up into numerous small squads, and succeeded in making their way across the Potomac at several fords. They captured about 1,000 horses during the march, and successfully completed one of the boldest dashes that have been made during the war.

OPERATIONS ON ST. JOHN'S RIVER, FLORIDA.

The following official report has been received by the Navy Department:—

UNITED STATES STEAMER VERMONT,
PORT ROYAL HARBOR, S. C., Oct. 5, 1862.

To Hon. Gideon Welles, Secretary of the Navy, Washington City:

SIR:—The Department is doubtless aware that an attack by the rebels had been made some time since on the gunboats employed on the inside blockade of St. John's River.

A battery had been erected on the St. John's Bluffs, and heavy guns planted, which kept those small vessels in the immediate vicinity of Mayport Mills.

Commodore Steadman, with a large force, had been ordered by Admiral Dupont to look to this. Having approached the fort and felt its troops, he urged that troops might be sent to aid in securing the garrison when the battery should be silenced by the gunboats, and to alter the insolent tone of the rebel military authority in that quarter.

General Mitchel, with his characteristic promptitude, detailed a suitable force for the purpose, under General Brannan, which sailed hence on the 30th ult.

I have now the honor to inform the Department that I have just received the report of Commodore Steadman, in which he informs me that the cooperating force under General Brannan having arrived and landed with great promptitude, the gunboats advanced, and after a spirited, and, as it seems, well directed fire, silenced the battery, which was then occupied by our force.

The rebels seem to have retired in much haste, leaving guns (nine in number—seven of which were 8-inch, and two 4½-inch rifles), munitions, provisions and camp equipage.

The success has been without loss on our side.

The vessels then ascended the St. John's to Jacksonville, and there learned that the rebel forces had retreated beyond that point.

We retain possession of St. John's River as far as Jacksonville.

WM. GODON, Captain,
Commanding South Atlantic Squadron.

POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The Association held its regular weekly meeting at its room at the Cooper Institute, on Thursday evening, Oct. 9, Dr. Rowell in the chair.

FISH'S LAMP.

One of the subjects presented during the half-hour devoted to miscellaneous business was the heating attachment for kerosene lamps, invented by W. L. Fish, of Newark, and illustrated on page 64 of our current volume.

Prof. SEELY—Mr. President, it gives me great pleasure to say that I think this is one of the best things in a small way that we have had for years, and I think the Society will earn some credit to itself by introducing this lamp to the public. It is a little article but of very wide application. It will certainly be a convenient article in every household, and in many manufacturing operations it will be useful. I think that I shall find it of service in the laboratory. It will be useful, if we may employ the word useful in this application, wherever spirits are dispensed. I think if it was properly presented to the authorities it would be adopted at once in every hospital in the army.

Mr. TILLMAN—The evaporation of water by passing a chimney or flue through the vessel is very old, and I suppose that all there is new in this is the adaptation of the principle to lamps.

Mr. CHURCHILL—It seems to me that unless the cup is set over the top of the chimney, as proposed in some cases by the inventor, a considerable portion of the caloric will be lost.

FUEL IN THE ARTS.

The chairman having called the regular subject of the evening, "Fuel in the Arts," the discussion of this was renewed.

Dr. STEVENS—There has been no furnace yet constructed that will burn properly all kinds of coal. On the Ohio river it is found that a furnace suitable for burning the bituminous coal of one region is not adapted to that which is found in other localities. An entirely different system is required for burning anthracite, from that which is suited to bituminous coal. Anthracite coal after it is once on fire should never be distributed. At my house after trying different plans I adopted the system of kindling the fire in the fall and keeping it constantly burning till spring, making no more disturbance of the fire than was necessarily incidental to replenishing with coal and removing the ashes. Bituminous coal, on the other hand, should be frequently stirred.

Mr. VEEDER—I desire to see the inventive talent of the country directed to some plan for burning the heavy rock oils, in their crude state, just as they come from the ground. The refined kerosene oil, such as is burning in this lamp, is worth about 40 cents per gallon, but the crude oil has been sold in this market at 10 cents per gallon. I believe that if the minds of inventors are directed to the matter we shall have some plan devised for burning the crude oil so perfectly that the great expense of refining will be dispensed with.

Mr. TILLMAN—From the report in the SCIENTIFIC AMERICAN I infer that this Society endorsed, at the last meeting, the furnace invented by Mr. Siemen. This furnace merely heats the air for the blast, a very old device. That there is a saving of fuel over other hot blast furnaces amounting to fifty per cent I do not believe. If you burn carbon into carbonic acid you produce all of the heat which the carbon will yield. Mr. Siemen first forms carbonic oxide, and then carries this gas off to another part of the apparatus and there burns it, producing carbonic acid; but he generates no more heat than he would by direct combustion to carbonic acid in the first place. Carrying about his substances through pipes and flues will not get any more heat out of them.

Mr. FISHER—It seems to me best to get at facts in regard to what has been done rather than indulge in hopes and speculations of what may be done. Bituminous coal has been burned in locomotives on the Illinois Central Railroad, and an analysis of the gases in the fire-box showed that the combustion was perfect—there was no carbonic oxide, nor any hydrocarbons. The same results have been produced in other places. The problem of making a furnace that will burn bituminous coal without smoke is already solved.

Mr. DIBBEN—One word before we adjourn, in reply to Mr. Tillman's remarks on Siemens's furnace. I conversed last week with a friend who had charge of one of these furnaces, and he says the economy is as high as stated. The temperature of the escaping gases has been measured by a pyrometer, and it is found that while in ordinary furnaces the products of combustion enter the smoke stack at a temperature of 2,600° to 3,000°, by Siemens's regenerators all but 300° of this heat is taken from them and imparted to the air and gas before they are combined in combustion, thus utilizing 2,300° to 2,700° of heat which are now wasted. The coal is first distilled into combustible gases and then these gases are heated before they are burned; the air to burn them being also heated. The gases produced by this combustion pass through interstices in two masses of brick work; heating them, and giving up their own heat, so that they enter the stack at the low temperature named. When the brick work becomes heated the hot products of combustion are turned through two other masses of brick work, and the air and gas are drawn through the two which have just been heated. It is by this saving of waste heat that the great economy is effected.

The same subject was adopted for the discussion next week, and the Association adjourned.

MISCELLANEOUS SUMMARY.

INCREASE OF RATS.—The *Farmers' Gazette* (English) asserts and proves by figures that one pair of rats will have a progeny and descendants amounting to no less than 651,050 in three years. Now, unless this immense family can be kept down, they would then consume more food than would sustain 65,000 human beings. It will be far wiser in the farmer to turn his attention to the destruction of rats than of small birds.

[Certainly it will. Whoever engages in shooting small birds is a cruel man; whoever aids in exterminating rats is a benefactor. We should like some of our correspondents to give us the benefit of their experience in successfully driving out these pests. We need something beside dogs, cats and traps for this business.—EDS.

PERHAPS the most curious specimen of ancient figure-weaving on embroidery now to be found is that preserved in the old cathedral of Bayeaux in France. It is a piece of linen about 19 inches in breadth, and 67 yards in length, and contains the history of the conquest of England by William of Normandy, beginning with Harold's embassy, A. D. 1065, and ending with his death at the battle of Hastings in 1066. This curious work was executed by Matilda, wife of William, Duke of Normandy, afterward King of England, and the ladies of her court. It is a most beautiful and exquisite piece of needlework.

MANUFACTURING FRESH WATER AT FORT PULASKI.—All the water used by the Union forces (the Forty-eighth New York regiment) at Fort Pulaski, Georgia, is condensed from steam generated from the salt sea water by Frederick Gilmore, from Paterson, N. J. When the need of water was felt, Gilmore constructed a condenser inside the fort, the condensing machines manufacturing four thousand five hundred gallons per day more than is consumed by the troops. This makes good drinking water and is used for all ordinary purposes. Before the erection of these works all the water had to be brought down in vessels from Beaufort and Bay Point. Mr. Gilmore is now chief superintendent of the whole concern.

COTTON SMUGGLED TO EUROPE.—It is ascertained that large supplies of cotton for different ports of Europe are obtained on the Rio Grande, and Mexican vessels are engaged in supplying foreign ships. It is suspected that Texan planters convey their cotton to Brownsville, Texas, whence the article is clandestinely carried to the Mexican border. On the 8th of September there were 20 vessels there waiting, including an English steamer which had 60,000 pounds sterling with which to purchase cotton of the United States.

THE great Suez ship-canal, which is being cut through the Isthmus, to connect the Mediterranean with the Red Sea, will be 91 miles in length, 260 feet in width, and 26 feet deep.

PROPOSED NEW POSTAL CURRENCY.—A Washington correspondent says that parties in New England propose a new style of postal currency. It is to inclose the Post Office (or postal currency) stamp in a circle of white metal, covered by a piece of mica making a circular metallic case with the stamp protected from the wear and tear of use. It has been approved by all who have seen it. It is stated that, at the present rate of issue of the postal currency, it will take eight years to bring out the fifty millions authorized by Congress. The inventors of this new style of currency propose to get up the stamps themselves at their own cost if allowed to issue these metallic currency. They think that by employing the button factories of New England they can very nearly supply the demand at such an advance as will be satisfactory to the bankers and to the public.]

A WRITER in the Boston *Post* says of lint:—Every ounce of lint sent to the army does mischief. Its only use is to cover up the blunders of bad surgery. It is seldom used by the best surgeons here. In the army it is crowded into wounds by men who know no other way to stop hemorrhage, and there it remains until it becomes filled with filth and maggots. It retains the discharges till they putrify, and produces an intolerable stench. The termination of its work is the death of the patient.

Is this true?

PRICES OF PROVISIONS, &c., IN RICHMOND, VA.—Coffee was selling in Richmond, a few days since, at $3 50 ℔ lb; tea at $16; sugar 60 cents @ $1; salt 60 cents ℔ quart; molasses $7 ℔ gallon; butter $1; potatoes $1 ℔ peck; United States Treasury Notes 100 ℔ cent premium; calico $1 50 ℔ yard; hoop skirts $15 a pair; a paper of pins $1 50; spool of cotton 50 cents; no ribbons to be obtained; gaiters $12 @ $15 ℔ pair.

AT a recent meeting of the Chemical Society, London, Mr. Greville Williams, F. R. S., read a paper, in which he stated that he had succeeded in obtaining the iodides of several alcohol radicals from Boghead naphtha. Acids, alcohols, ethers, aldehydes, alkaloids, &c., may now be produced from naphtha almost to infinity. Mr. Williams has already procured the iodides of amyle, œnanthyle, capryle, and the new alkaloids œnanthylamine and pelargonamine.

A "PAIN-FUL" EXPERIMENT.—A man named John Payne, of Keeseville, Essex County, N. Y., made a bet of $7 against a barrel of flour, recently, that he could carry the barrel of flour on his back from a store to his mother's residence, a quarter of a mile distant, up a steep hill, without resting. He accomplished the feat, and won the flour. Payne ought to be at the war.

DURING the present year six new steamers carrying 1,754 tuns have been built at Cincinnati, and the number of steamboats running on the Ohio river from that city is 186 of 46,435 tuns. The imports of Cincinnati for the year ending August 31, 1862, were valued at $108,292,823, the exports for the same period were valued at $76,449,862.

IMPORTS OF FOREIGN IRON.—The *Engineer* states that a large number of orders are being received from North America for general descriptions of iron, notwithstanding the rate of the exchanges and the high tariffs. Iron is now being taken from Liverpool to New York for 4*s.* sterling per tun.

TWELVE vessels laden with cotton from India arrived at Liverpool on the 26th of September. Their aggregate cargoes amounted to 546,000 bales. One of the vessels carried 6,056 bales, the smallest vessel 3,490 bales.

Ships for the South.

The Liverpool *Telegraph* says:—Besides the commissions committed to other ship-builders by the Confederate Government, which are being pushed forward with all possible dispatch, a large iron-plated ram is being constructed on the river Mersey, without any attempt being made at concealment. This ram will be of the most formidable character, and will attempt to run the blockade at Charleston. The same journal says that a vessel is lying at Liverpool, taking in a cargo of iron plates, destined for plating a Southern vessel, which is waiting their arrival at Charleston.

THE PROPERTIES OF IRON AND ITS RESISTANCE TO PROJECTILES AT HIGH VELOCITIES.

BY WILLIAM FAIRBAIRN, ESQ., F.R.S.

[Continued from page 245.]

Having ascertained, by direct experiment, the mechanical resistance of different kinds of iron and steel plates to forces tending to rupture, it is interesting to observe the close relation which exists between not only the chemical analysis as obtained by Dr. Percy, but how nearly they approximate to the force of impact, as exhibited in the experiments with ordnance at Shoeburyness.

Dr. Percy, in his analysis, observes, that of all the plates tested at Shoeburyness, none have been found to resist better than those lettered A, B, C, D, with the exception of C. The iron of plate E contained less phosphorus than either of the three, A, B, D; and it is clearly established that phosphorus is an impurity which tends in a remarkable degree to render the metal "cold short," *i. e.* brittle when cold.

The following table shows the chemical composition of these irons :—

Mark.	Carbon.	Sulphur.	Phosphorus.	Silicon.	Manganese.
A	0·01636	0·104	0·106	0·122	0·28
B	0·03272	0·121	0·173	0·160	0·029
C	0·023	0·190	0·020	0·014	0·110
D	0·0436	0·118	0·228	0·174	0·250
E	0·170	0·0577	0·0894	0·110	0·330

Comparing the chemical analysis with the mechanical properties of the irons experimented upon, we find that the presence of 0·23 per cent of carbon causes brittleness in the iron; and this was found to be the case in the homogeneous iron plates marked C; and although it was found equal to A plates in its resistance to tension and compression, it was very inferior to the others in resisting concussion or the force of impact. It therefore follows, that toughness combined with tenacity is the description of iron plate best adapted to resist shot at high velocities. It is also found that wrought iron, which exhibits a fibrous fracture when broken by bending, presents a widely-different aspect when suddenly snapped asunder by vibration, or by a sharp blow from a shot. In the former case the fiber is elongated by bending, and becomes developed in the shape of threads as fine as silk, whilst in the latter the fibers are broken short, and exhibit a decidedly crystalline fracture. But, in fact, every description of iron is crystalline in the first instance; and these crystals, by every succeeding process of hammering, rolling, &c., become elongated, and resolve themselves into fibers. There is, therefore, a wide difference in the appearance of the fracture of iron when broken by tearing and bending, and when broken by impact, where time is not an element in the force producing rupture.

If we examine with ordinary care the state of our iron manufacture as it existed half a century ago, we shall find that our knowledge of its properties was of a very crude and most imperfect character. We have yet much to learn, but the necessities arising from our position as a nation and the changes by which we are surrounded, will stimulate our exertions to the acquisition of knowledge and the application of science to a more extended investigation of a material destined, in course of time, to become the bulwark of the nation. It is, therefore, of primary importance, that we should make ourselves thoroughly acquainted, not only with the mechanical and chemical properties of iron, but we should moreover be able to apply it in such forms and conditions as are best calculated to meet the requirements of the age in which we live.

Entertaining these views, I cheerfully commenced with my talented colleagues the laborious investigations in which we are now engaged, and looking at the results of the recent experiment with the 300-pounder gun on the one hand, and the resisting targets on the other, there is every prospect of an arduous and long-continued contest.

From the Manchester experiments, to which I have alluded, we find that with plates of different thicknesses, the resistance varies directly as the thickness, that is, if the thickness be as the numbers 1, 2, 3, &c., the resistance will be as 1, 2, 3, &c.; but those obtained by impact at Shoeburyness show, that up to a certain thickness of plate, the resistance to projectiles increases nearly as the square of the thickness. That is, if the thickness be as the numbers 1, 2, 3, 4, &c., the resistance will be as the numbers 1, 4, 9, 16, &c., respectively. The measure, therefore, of the absolute destructive power of shot is its *vis viva*, not its momentum as has been sometimes supposed, but the work accumulated in it varies directly as the weight of the shot multiplied into the square of the velocity.

There is, therefore, a great difference between statical pressure and dynamical effect; and in order to ascertain the difference between flat-ended and round-ended shot, a series of experiments were undertaken with an instrument or punch exactly similar in size and diameter and precisely corresponding with the steel shot of the wall piece ·85 diameter employed in the experiments at Shoeburyness. The results on the A, B, C, and D plates are shown in the following table :—

Character of Plates.		Resistance in lbs. Punch Flat-ended.	Punch Round-ended.
Half-inch thick...	A Plates..	57,956	61,886
	B Plates..	57,060	48,788
	C Plates..	71,035	85,524
	D Plates..	49,080	43,337
Three-quarter-inch thick.....	B Plates..	84,587	98,420
	D Plates..	82,381	98,571
Mean.....		67,017	72,754

These figures show that the statical resistance to punching is about the same whether the punch be flat ended or round ended, the mean being in the ratio of 1000 : 1085 or 8½ per cent. greater in the round-ended punch. It is, however, widely different, when we consider the depth of indentation of the flat-ended punch and compare it with that produced by the round-ended one, which is 3½ times greater. Hence, we derive this remarkable deduction, that whilst the statical resistance of plates to punching is nearly the same, whatever may be the form of the punch, yet the dynamic resistance or work done in punching is twice as great with a round-ended punch as with a flat-ended one. This of course only approximately expresses the true law; but it exhibits a remarkable coincidence with the results obtained by ordnance at Shoeburyness, and explains the difference which has been observed in these experiments, more particularly in those instances where round shot was discharged from smooth-bored guns at high velocities. To show more clearly the dynamic effect or work done by the weight of shot which struck some of the targets at different velocities, the following results have been obtained :—

Target.	Weight of Shot striking Target; lbs.	Work done on Target. Total Foot lbs	Per square Ft. Foot lbs.
Thorneycroft 8-inch Shield...	1253	—	29,078,000
Thorneycroft 10-inch Embrasure.....	1511	—	37,140,000
Roberts's Target.....	946	822,000	19,726,000
Fairbairn's Target.....	1024	324,000	23,311,000
Warrior Target.....	3229	312,000	62,570,000
The Committee's Target.....	6410	—	124,098,780

From the above, it will be observed, that the two last targets have sustained in work done what would, if concentrated, be sufficient to sink the largest vessel in the British navy.

We are all acquainted with the appearances and physical character of artillery, but few are conversant with the nature of the operations and the effects produced by shot on the sides of a ship or on resisting forts and targets.

The shot of a gun—to use the expression of my colleague, Mr. Pole—is simply the means of transferring mechanical power from one place to another. The gunpowder in the gun developes by its combustion a certain quantity of mechanical force, or work as it is now called, and the object of the shot is to convey this work to a distance, and apply it to an object supposed to be otherwise inaccessible. The effect of this, according to Mr. Pole's formula, is—

W=weight of the shot in lbs.

V=its velocity in feet per second.

Then, by the principle of *vis viva*, the quantity of work stored up by the moving mass, measured in lbs., one foot high, is

$$= \frac{WV^2}{2g}$$

g being the force of gravity=$32\frac{1}{6}$.

Thus, if we have a shot, like that recently used against the *Warrior* target, 156 lbs., moving at the rate of 1700 feet per second, the work done will be—

$$= \frac{156 \times (1700)^2}{64\frac{1}{3}} = 7{,}008{,}238 \text{ one foot high.}$$

Showing at once the immense power that this small body is able to deliver on every resisting medium tending to arrest its course and bring its particles to a state of rest. Or, in other words, it is equivalent to raising upwards of 3,000 tons a foot high in the air.

THE APPLICATION OF IRON FOR PURPOSES OF DEFENCE.

Having examined in a very condensed and cursory manner the present state of our knowledge in regard to iron, and its application to the purposes of shipbuilding, let us now consider in what form and under what circumstances it can best be applied for the security of our vessels and forts. To the latter the answer is, make the battery shields thick enough: but a very different solution is required for the navy, where the weight and thickness of the plates is limited to the carrying powers of the ship. It has been observed with some truth that we have learned a lesson from the recent naval action on the American waters; but it must be borne in mind that neither of the vessels engaged nor the ordnance employed were at all comparable to what have been used at Shoeburyness.

To those who, like myself, have gone through the whole series of experiments the late engagement will appear instructive, but not calculated to cause any great alarm, nor yet effect any other changes than those primarily contemplated by the Government, and such as have been deduced from our own experiments. It is, nevertheless, quite evident that our future navy must be entirely of iron; and judging from the last experiment with the Armstrong smooth-bore gun, it would almost appear as a problem yet to be solved, whether our ships of war are not as safe without iron armor as with it. If our new construction of ships are strong enough to carry armaments of 300 pounder guns, which is assumed to be the case, our plating of 6 or 7 inches thick would be penetrated, and probably become more destructive to those on board than if left to make a free passage through the ship. In this case we should be exactly in the same position as we were in former days with the wooden walls; but with this difference, that if built of iron the ship would not take fire and might be made shell proof. It is, however, very different with forts, where weight is not a consideration, and those I am persuaded may be made sufficiently strong to resist the heaviest ordnance that can be brought to bear against them. In this statement I do not mean to say that ships of war should not be protected, but we have yet to learn in what form this protection can be effected to resist the powerful pieces of ordnance, and others of still greater force which are looming in the distance, and are sure to follow.

A great outcry has been raised about the inutility of forts; and the Government, in compliance with the general wish, has suspended those at Spithead; I think improperly so, as the recent experiments at Shoeburyness clearly demonstrate that no vessel, however well protected by armor plates, could resist the effects of such powerful artillery; and instead of the contest between the *Merrimac* and *Monitor*, and that of the 300-pounder gun being against, they are to every appearance in favor of forts. Should this be correct, we have now to consider how we are to meet and how resist the smashing force of such powerful ordnance as was leveled against the *Warrior* target.

During the whole of the experiments at Shoeburyness I have most intently watched the effects of shot on iron plates. Every description of form and quality of iron has been tried, and the results are still far from satisfactory; and this is the more apparent since the introduction of the large 300-pounder, just at a time when our previous experiments were fairly on the balance with the 40, 68, 100, and 126 pounders. They now appear worthless, and nothing is left but to begin our labors again *de novo*.

It has been a question of great importance, after having determined the law of resistance and the requisite quality of the iron to be used as armor plates, how these plates should be supported and attached to the sides of the ship. Great difference of opinion continues to exist on this subject, some are for entirely dispensing with wood; probably the greater number contend for a wood backing, the same as the *Warrior* and the *Black Prince*. I confess myself in the minority on this question; and, judging from the experiments, I am inclined to believe from past experience that wood combined with iron is inferior to iron and iron in its power of resistance to shot;

and I am fully persuaded that ultimately the iron armor plates must be firmly attached to the side, technically called the skin, of the ship. It must, moreover, form part of the ship itself, and be so arranged and jointed as to give security and stability to the structure.

The experiments instituted by the Committee on Iron Plates have been well considered and carefully conducted; they commenced with a series of plates selected from different makers of varying thicknesses, and these have been tested both as respects quality and their powers of resistance to shot. They have, moreover, been placed at different angles and in a variety of positions, and we had just arrived at the desired point of security, when the thundering 300-pounder smooth bore upset our calculations and levelled the whole fabric with the ground. We are, however, not yet defeated; and true to the national character, we shall, like the knights of old, resist to the last—

"And though our legs are smitten off,
We'll fight upon our stumps."

And thus it will be with the Iron Committee and the Armstrong and the Whitworth guns.

In conclusion, allow me to direct attention to a drawing of the *Warrior* target, with wood backing and its compeer entirely of iron. The first underwent a severe battering, previous to the attack from the 300-pounder, but the other sustained still greater, with less injury to the plates, notwithstanding the failure of the bolts in the first experiment. It must, however, be admitted that plates on wood backing have certain advantages in softening the blow, but this is done at the expense of the plate, which is much more deflected and driven into the wood, which, from its compressibility, presents a feeble support to the force of impact. Again, with wood intervening between the ship and the iron plates it is impossible to unite them with long bolts so as to impart additional strength to it; on the contrary, they hang as a dead weight on her sides, with a constant tendency to tear her in pieces. Now, with iron on iron we arrive at very different and superior results. In the latter, the armor plates, if properly applied, will constitute the strength and safety of the structure; and, notwithstanding the increased vibration arising from the force of impact of heavy shot, we are more secure in the invulnerability of the plates, and the superior resistance which they present to the attack of the enemy's guns. In these remarks I must not, however, attempt to defend iron constructions where they are not defensible, and I am bound to state that in constructions exclusively of iron there is a source of danger which it is only fair to notice, and that is, that the result of two or more heavy shot, or a well-concentrated fire, might not only penetrate the plates, but break the ribs of the ship. This occurred in the last experiment on my own target, where a salvo of six guns concentrated four on one spot, not more than 14 inches in diameter, went through the plates and carried away a part of the frame behind. The same effect might have taken place on the *Warrior* target; and certainly 9 inches of wood are of little value when assailed by a powerful battery of heavy ordnance and a well-concentrated fire.

In closing these remarks, I have every confidence that the skill and energy of this country will keep us in advance of all competitors, and that a few more years will exhibit to the world the iron navy of England, as of old with its wooden walls, unconquerable on every sea.

CHARACTER, CULTIVATION AND USE OF THE LUPINE.

We continue this week our valuable extracts from the agricultural volume of the Patent Office Report for 1861, by publishing in full the article on the Lupine, by Louis Schade, of Washington, D. C.:—

During my visit to Europe, particularly to Prussia, in the latter part of the summer of 1861, my attention was called, by the kind assistance of some of the higher officials of the Prussian agricultural department, amongst whom I mention especially the name of the *œconomie commissarius* (commissary of economy), M. Krocker, at Berlin, to the extensive cultivation of a plant which has made quite a revolution in agricultural affairs in that part of the world. This plant is the lupine, known in this country as a garden flower. From trials made during the last ten years in Northern Germany it was shown that it not only makes excellent fodder for cattle, especially for sheep, but that it also has the most astonishing fertilizing power if used as green manure. It is now cultivated extensively, and, as I was told by Prussian agriculturists, it may be said that farming in that country has entered into a new stage, so great are the extraordinary benefits afforded by this plant. It will grow on the poorest soil unassumingly, and without pretensions to laborious cultivation. Large estates, which, on account of light, sandy or exhausted lands, were almost worthless, are now, by the cultivation of the lupine, producing in value as much as those of the best soil. Where formerly, from want of meadows, a hundred sheep were kept, a thousand will now get through the winter without trouble by using the lupine as fodder. Even the quantity of wool shorn will increase from eight to ten per cent, as the sheep are very fond of this nourishing plant and its seed.

It is remarkable that the lupine, with all the benefits it bestows, should have been forgotten for centuries. The ancient Romans cultivated it just for the above-mentioned reasons. This is another proof that, if we may excel in machinery and other scientific inventions at the present time, the ancient people were not much, if at all, behind us in the art of cultivating the soil. Theophrastus (who lived from 370—286 before Christ) speaks of the lupine in his *History of Plants*. Marcus Portius Cato Censorius (232—147, before Christ), mentions the same in his work on agriculture, and in the *XII libri de re rustica* of Columella, and also in Pliny, we find an explicit statement concerning its cultivation and use. They say that "the lupine will grow without manure on exhausted soil, also on red clay and on coarse, especially ferruginous sand, whilst lime soil, and particularly wet lands, will not agree with it. The lupine serves especially as green manure," &c.

Being firmly convinced that the lupine, if introduced by our farmers into this country, will be a God-send to all those who have either light, sandy, or exhausted soil, I consider it a matter of the highest importance that some trials with the same should be made, especially on the sand lands of New Jersey, and the worn-out lands in Pennsylvania, Maryland, Kentucky, and other States; particularly on the so-called "old fields," exhausted by an extensive and constant cultivation of tobacco, the lupine will prove an excellent and a very cheap manure. Guano is not only high priced, but, as it has more stimulating than fertilizing qualities, well enough to be employed with advantage on good, not worn-out clay soil; it is even injurious on lands of the above description.

The following facts respecting the character, cultivation, and use of the lupine, I have collected partly from personal observations, partly extracted from reliable writings recommended for that purpose by the above-mentioned member of the Prussian (agricultural) administration.

Of the eighty-three different species of the lupine, only three have, thus far, been used for agricultural purposes, namely, the yellow lupine (*Lupinus Luteus*), the blue lupine (*Lupinus Angustifolius*) and the white lupine (*Lupinus albus* or *termis*). Of these three, the yellow lupine is considered the most useful, though the blue lupine is also extensively cultivated. The white lupine we find especially in Southern France, in the triangle between Valence, Lyons and Grenoble. The principal objections which German agriculturists entertain against the white lupine consist in its being more a southern plant, and not always getting ripe in higher latitudes; and then it cannot be used as fodder, as it causes symptoms of disease amongst the cattle. Its cultivation in Northern Germany, has, therefore, entirely been abandoned. The yellow lupine is the best adapted to be cultivated in this country. It is the same which we have been growing in our gardens, being the only one of the eighty-three species the flower of which has a sweet, honey smell. The blue lupine is also useful, and it would be well if some trials with it should be made; the more so, as its seed ripens more equally than that of the yellow lupine; for if the beans of the lupine are not dry, or even if some green beans are amongst them, they are all apt to get mouldy, becoming entirely useless either for feeding or seed. The transport of this seed across the ocean will, therefore, on account of the dampness existing on board of vessels, be no easy matter, and winter months should be selected as the best time. Besides, great care ought to be taken to buy the best-ripened fruit; for as the lupine culture is entirely unknown in this country, it will, therefore, require considerable encouragement at the start, otherwise its introduction will be postponed, notwithstanding the great benefits which particularly our Eastern farmers will derive therefrom. I repeat again that the greatest pains must be taken in getting good seed. None but perfectly dry seed ought to be bought. Any other will not grow.

SOIL.

The several species of lupine thus far cultivated require a soft, mellow soil. On a hard clay soil its cultivation will not be profitable, as the hardness of the ground will prevent the root from penetrating deep enough. It will, therefore, be necessary to plow the land at least twice before sowing, particularly if it has not been under cultivation for many years. The lupine will not grow on very wet soil, where the water will be standing for some months in the year. Carbonic lime is also obnoxious to this plant. Light sandy soil, containing iron, such as we find in the vicinity of Washington, is preferable. Fresh sand is particularly to be recommended.

CULTIVATION.

The lupine requires a mellow soil, and permits only a very slight covering of earth. It desires also warmth and moisture to germinate and grow. To plow the seed under is not advisable, as especially the yellow lupine will not grow when too deep in the ground. Light harrows will suffice. In some instances, when a considerable quantity of rain fell immediately after the sowing, the harrowing has been entirely omitted. The month of April, and perhaps the commencement of May, will be the best time for sowing. But it should never be done before the grass begins to grow, as the plant is very sensible of night frosts. If the weather is dry the lupine beans will not shoot very quick. In Prussia ten to sixteen metzen are usually sown out per morgen. For seed, if not for green manure, eight metzen will suffice. If, however, it is desired to grow as much seed as possible, sixteen to twenty metzen are sown. The plants will then stand so closely together that they will get only a few branches, thus becoming more uniformly ripe.

GREEN MANURE.

There can be no doubt that the lupine, if introduced into this country, will chiefly be cultivated for the purpose of serving as green manure on light and exhausted lands. As such it will, in fact, be a blessing to our farmers. In Northern Germany about twelve to fourteen metzen per morgen (two bushels per acre) are usually sown, if to be used in this manner. The yellow lupine is best adapted to green manuring. It will grow, according to soil, three and even four feet high. The plowing under ground of the green lupine can be done during or immediately after the time of flowering, which time, if the seed has been sown in May, will most probably in this country arrive at the latter part of July and beginning of August. In Prussia the farmers first employ a large roller to crush down the plant, and then commence plowing. Others fasten to the plow before the share a strong broom made of twigs, which presses the plant to the ground until it is covered with earth. This latter is the most usual way. Of course, a field where so great a mass of herbs is embodied has not a very smooth appearance. This done, rye or wheat, or any other winter fruit, can be sown either immediately, or, as is more customary, after waiting a fortnight. The harrowing in of the grain must never be done across the furrows. It must be parallel with the furrows, beginning from the opposite side whence the plow started, otherwise the lupine roots will be torn out, and the land assume a hilly appearance. Another process is to roll down the lupines, sow upon them the grain, and then plow the whole but not very deep. It may be well, according to moisture and warmth, to let the grain thus sown lie two or three days before plowing. The crop will at first look not as well as that harrowed in, but will afterward acquire stronger haulms and heavier ears. It must, however, be remembered that the fertilizing power of lupine manure extends not beyond one year.

If the lupine is to serve as manure for field fruits such as oats, potatoes, &c., which are not to be sown in the fall but in the spring, the land may also be

plowed in the fall. But experienced agriculturists advise in this case to let the plant remain during the winter on the field, and then plow it under in the spring. Oats, if sown on such land in the furrow (*i. e.* before harrowing), will especially thrive. The same will be the case with barley.

THE FERTILIZING POWER OF THE LUPINE.

The secret of the fertilizing quality of the lupine is to be found in the following observations :

1. The root of the lupine, which contains a large quantity of moisture similar to the turnip, absorbs more energetically than any other plant the phosphate of iron and natural ammoniac of the soil, thus making the latter more digestible and accessible to other plants.

2. It dissolves the chemical constituents of minerals by the evaporation of its root, which is impossible for other plants; just as the ostrich can dissolve and digest things in its stomach which would be death to any other bird. Thus the surface soil becomes enriched with a humus containing ammonia and a considerable quantity of alkali, phosphate, &c. So great is the effect that after manuring with the lupine for two or three years, the soil will assume a darker color. This observation is based upon facts. Even if the plant has been cut and used as fodder, the remaining stubble and root will have a very beneficial effect as manure, though of course it is preferable to plow under the whole plant.

3. What has been said about the root applies equally to the plant. It has the capability to absorb, in an increased measure, nitrogen and carbon out of the atmosphere, and does not draw upon the humus for its development and growth, as in the case with other manure plants. The lupine communicates its oxygen as ozone, forming thereby in the air which surrounds it ammonia containing nitric acid, something which partly benefits the lupine itself, partly the soil, and also those plants growing in the immediate vicinity and needing manure.

THE SEED OF THE YELLOW LUPINE.

There exists hardly a plant which needs so much as the lupine that the seed should be perfectly ripe, as unripe seed will either not grow at all or the plant will present only a sickly appearance. The gathering of the seed is very difficult. The lower pods will either ripen sooner than the upper ones, burst, and scatter the seed, or some groups of lupines will finish their vegetation sooner than others. But these latter observations have chiefly been made in more northerly climates, and therefore these inconveniences may not exist in our country at all, or at least only in a small degree. The best seed is obtained by cutting and gathering the ripe pods, but that is laborious and troublesome. As, however, the lupine beans have a high fertilizing quality, nothing will be lost by their being scattered on the field. Some farmers have pulverized and used them as surface manure with great success.

The chemical composition of the lupine beans is as follows :—

	Yellow lupine.	Blue lupine.
Water	12·2	13·2
Compounds of nitrogen	28·3	22·0
Therein pure nitrogen	4·5	3·5
Oil	5·0	5·6
Soluble matter containing no nitrogen	36·4	43·8
Organic matter, vegetable fibers	14·1	12·2
Minerals	4·0	3·2

GENERAL REMARKS.

As during the first years after its introduction the lupine will chiefly be used for manuring purposes, it will hardly be worth while to say much at present of its value as fodder. It being a very rich and nourishing plant, great care must be taken to prevent sheep and cattle from eating too much of it. After rain sheep should not be permitted to graze on a lupine field. The lupine, in this respect, should be treated just as clover, vetches, &c. These remarks, it is thought, will be sufficient to induce experiments on a scale adequate to what is believed to be the importance of this plant.

SMALL POX has been committing great ravages among sheep in England, and the utility of inoculating from is advocated. In a Mr. Harding's flock of four hundred and forty-six inoculated, four hundred lived, and out of five hundred lambs, only two died. A neighboring flockmaster has been equally successful; while where the disease was taken naturally, sixty-eight per cent were lost.

Correspondence

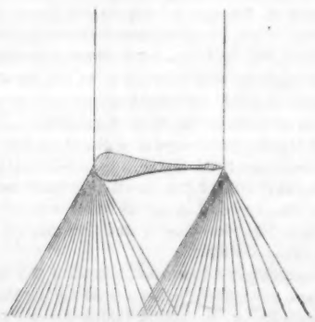
A Curious Property of Feathers.

MESSRS. EDITORS :—Letters Patent for my improvement in the let-off motion is received. Accept my thanks for the prompt manner in which you have, in every case, prosecuted my claims before the Patent Office.

Allow me to trouble you with a question in regard to which, without a good microscope, I have been unable to arrive at a satisfactory conclusion :—I find that a feather or quill of any color, from the tail or wing of any common fowl, when in good order and perfectly dry, possesses the property of dividing the rays of light into its constituent parts as colors, nearly as well as a triangular transparent prism. The feather being an opaque body, it is supposed to be incapable of refraction, how then is this result obtained, unless it be by the diffraction of light (first observed by Grimaldi)? And if so (as I suspect) the feather is a very simple and satisfactory demonstration of this peculiar law of optics. To make the experiment referred to, you have only to look through a feather—black is the best—at the sun or the flame of a common lamp at night; if the flame is flat, as most in use now are, let the edge be toward you. You will observe, if you try this simple experiment, that the red rays are invariably farthest from the flame. May I have your opinion on this subject, and much oblige R. R.

Stockport, N. Y., Oct. 1, 1862.

There can be no doubt that this is a case of diffraction; one of the most singular and mysterious of all of the actions of light. When a ray of light passes by any sharp edge it is scattered or dispersed, and the details of this action have been very closely studied. If a razor is held with its flat side to the sun, the rays that pass near the edge will be scattered, some being thrown inward under the razor, and a smaller portion outward. Those that pass near the back are also scattered, but of these the larger number are thrown outward. The action in both cases is illustrated in the cut :—



If, in the place of a broad razor a very narrow body is used, the rays that are deflected inward cross each other and produce dark lines by interference, and these dark lines are bordered by colored fringes. The numerous fine rays of a feather cause these phenomena of diffraction.

A Kaleidoscopic Camera.

MESSRS. EDITORS :—The day is near at hand, I hope, when Niepce de St. Victor, of Paris, or perhaps some one of our own ingenious countrymen, shall succeed in taking photographic pictures in their own colors. When that longed-for discovery shall have been made, many benefits will result from its application. Let me suggest one.

Every body is familiar with that little instrument invented by Dr. Brewster, and called a kaleidoscope. To the eye of the observer, it presents an infinite variety of forms and colors, which, though ever changing, are yet always beautiful. Let the photographer once combine the kaleidoscope with the camera, and then see with what ease and rapidity he can produce the most charming designs for dress goods, tapestry, oil cloth, wall paper and numerous other purposes. Such a thing is possible. Do you doubt it? I have faith.

FRANCIS J. COLLIER.

Philadelphia, October 8, 1862.

The Salt Basins of Nebraska.

There is in Nebraska Territory, 50 miles west of the Missouri river, a remarkable salt region of which the Government has reserved 17,000 acres under the Mineral-land Act. Near the center of this region there are four basins containing 1,600 acres. Their surface is nearly flat, but depressed several feet below the common level. As to the cause of this depression no certain theory prevails—some claim that the millions of buffalo, &c., which have salted and wallowed there for ages, have done it. Others claim that the slow wash caused by the salt's destroying vegetation will account for it. The bottoms of the basins are composed of black mud covered over in warm, dry weather with a thin stratum of salt, causing them to look like magnificent fields of snow. The salt is collected by scrapers; occasionally a man will scrape up a wagon load in a day.

In and about those basins are numerous springs of strong brine boiling up. The quantity discharged from them, if all in one stream, would run a sawmill. The farmers for a hundred miles round go there and boil and scrape enough for home use. The salt is of excellent quality—crystals white and large. It is astonishing that no works have been erected for manufacturing it. Our merchants obtain salt from New York and Virginia, when enough might be made here to supply a dozen States. This dry, breezy climate is far superior for solar evaporation to that of Onondaga. The vats that yield 2,000,000 bushels there would turn off 3,000,000 here. Timber is too scarce to be largely used in evaporation.

W. T. ROBINSON.

Omaha, Nebraska, Oct. 2d, 1862.

Revolving Turrets—An Old Invention.

As considerable controversy has arisen as to who was the original inventor of revolving gun turrets, the following extract taken from the *New York Evening Post*, June 1843, will throw some light on the subject :—

On the corner of Greenwich and Liberty streets there is a model of a battery, which is of a novel and destructive character. It is erected in a circular form, and presents four tiers of guns. The plan of the battery is, indeed, similar to any other of that form. The important difference consists in the manner by which its armament is brought to bear upon an object. For this purpose it is made to revolve upon its center, and if this revolution is performed in one minute and the armament comprises a hundred guns, each one of them may in that period of time be discharged at the object. In no other way can so great a number of guns be brought to bear upon an object in so short a time.

It is designed to put this in practice by erecting a circular fort of 50 or 100 feet in diameter, of plates of wrought iron. By means of steam power under ground, which shall cause it to revolve on its center, all the guns of this fort will be brought to bear at each revolution on a given object. The practicability of the plan remains to be tested, and the most important point would be to produce easy, uniform and rapid revolutions of so large a mass; though it would be smaller and less frail than some structures moved by mechanics at the present day.

[The above was sent to us by Mr. Fred. A. Hawley, of Windsor, Vt., who states he cut it from a Boston paper, published June 1843, accredited to the *Evening Post* of this city.—EDS.

Mineral Oil.

Notwithstanding the extremely adverse commercial influences which cripple trade in the United States, returns show (says a London paper) that between the 1st of January and the 23d of June last, no less than 4,284,185 gallons of mineral oil have been shipped to Europe from New York, Philadelphia, Boston and Baltimore. The entire country adjoining the Ohio below Pittsburgh abounds with this oil, which exudes from the banks in such quantities as to form a film of oil on the river for a distance of seventy miles. The prismatic hues of the oil, when the sun is shining, are extremely beautiful.

AT a recent meeting of the Scinde Railway Company, in London, it was stated that the cotton crop of Scinde, India, would exceed 50,000 bales, and the next year's growth is expected to be twice that quantity.

PHOTOGRAPHY AND FORGERY.

The following interesting article is from the *Photographic News* :—

The facilities afforded by photography, and more especially by photolithography, for effecting forgeries of bank notes and other documents, appear to have been considerably overlooked by those who are, or should be, most concerned. The sources of danger have been looked for in other directions, and it is from the imitative skill of the skillful engraver that counterfeit productions have been feared. In regard to Bank of England notes, a great safeguard has been believed to exist in the inimitable character of the paper, in quality, design of water mark, &c. But since the robbery of bank note paper, from the Laverstock Mills, this reliance has vanished into thin air, as the genuine paper manufactured for the bank authorities is now actually in circulation as the basis of the forgery. The bank authorities themselves rely upon the simplicity of the design and characters upon their notes, and upon the mode of printing adopted as their surest protection against imitation. Others maintain that complexity of design, produced by artists of the first ability, is the truest source of safety, arguing that, notwithstanding the skill and enterprise which have, unfortunately, been engaged in the nefarious profession of the forger, it must always happen that genuine art will be in advance of the spurious, or counterfeit art. It is further argued that the number of persons who would be able, with any chance of success, to imitate the designs of genius, must necessarily be very few, and "these," as it is argued by an old writer on the subject, "by the legitimate use of their talents, can acquire competence; they, therefore, are not likely to employ their time, or risk their lives, in felonious imitations. Nay, if, in the perversity of the human mind, a first-rate artist were inclined to turn forger, he could not then do it successfully, because, even in the very first rank of historical engravers, one cannot imitate the engraving of another in a work of importance without the difference of manner being visible."

Adopting these and similar arguments, the bank authorities have held, we believe, that their position was impregnable, and that the precautions against forgeries of their notes were as complete as it was in the nature of things, or at least in the present state of science, possible to make them. Moreover, they may, and we believe do, argue, no forgery has ever yet been executed which they could not, themselves, detect; and as they could only become losers by counterfeits produced with such skill as to deceive their own tellers, and induce them, without question, to convert them into specie, they were not called upon to entertain further anxiety upon the subject. They believe that their own safety from deception is absolute, and that, for the public safety, they have done sufficient, or, at least, all that was possible; and there the matter must rest.

But the imitation produced by photography is absolute in all its parts. The most complex design of the most skillful artist is as easily produced as the most simple commonplace production of the greatest bungler. The secret marks, however unobtrusive; the signature, no matter how marked its individuality or character, are all unerringly produced by the lens and camera, in the negative image. The ordinary silver print from such a negative, it is true, whilst it might deceive some persons if well executed, would speedily be detected on careful examination. It is for this reason, we doubt not, that the subject has received comparatively little attention, and excited no apprehension hitherto. But this is not the real danger. It is from the processes of photolithography, photoglyphography, and similar processes, by which photographic impressions can be produced in printer's ink, in the very material, and of the exact tint of the original, that the danger is to be apprehended; and that danger threatens the bank authorities themselves as well as the public, for it is possible to produce, by these means, imitations, which not the most skillful teller, or the most practiced expert, could detect, or make oath as to the forgery.

Let us take the case of photozincography, photolithography, or the processes which have at present attained the highest state of perfection. The first of these methods, the invention of Colonel James, is practiced at Southampton, for the production of the maps produced in the Ordnance Survey. The second, the invention of Mr. J. W. Osborne, is practiced under his superintendence, at Melbourne, for the production of the maps and plans issued by the Colonial Government of Victoria. Specimens of the work of both these gentlemen are exhibited in the International Exhibition. *Fac-similes* of maps, engravings, manuscripts, pages of printed books are exhibited, all of which would defy detection. These are gentlemen, it may readily be said, from whom there is no danger of forgery. But their processes are made public; and not only may be, but actually are, practiced by others. We refer those interested in the matter again to the International Exhibition; Mr. Ramage, of Edinburgh, exhibits a series of photographs in the British Photographic Department, perhaps the finest we have seen. By which process they are produced is not stated, but it is probale that the method is similar to that of Mr. Osborne. They are very perfect copies of engravings, and we have no hesitation whatever in saying, that, by the same method and the same manipulator, *fac-similes* of Bank of England notes might be produced which would entirely defy detection. It so happens, that these notes offer very especial advantages for imitating by such means. The design is clean, bold, and well marked: they are produced, not from engraved plates, in intaglio, printed at the copper-plate press, the printed impression of which always presents a slight amount of relief which may be felt by the finger; but by block printing at an ordinary typographic press. Such an impression can, therefore, be imitated by the photolithographer without difficulty, and in such a manner that the Bank authorities themselves may be deceived.

Mr. Osborne, who is now in London, on a visit to the Exhibition, recently informed us, that wishing to call the attention of bankers in Melbourne to this danger, he produced by photolithography copies of various of their signatures, of which they admitted they would be unable to repudiate the genuineness. Any color of ink, resembling either printing or writing ink, or any number of colors, may, of course, be easily produced, so that an actually written signature, instead of the printed signature now used, would not be an absolute safeguard.

We do not enter at present into any extended examination of the means by which such forgeries might be prevented, our object being rather to call the attention of those concerned to the existence and imminence of the danger. The means of prevention require careful consideration, and are not so easy and simple as might at first sight appear. Some years ago the subject came under consideration in the United States and in Canada. Colored inks were employed for some parts of the note, and black for the other; but it was found that the colored inks, not possessing, like black, a carbon basis, were easily discharged by chemical means, and photographic copies of the remainder easily produced, the colored portion being supplied by a subsequent operation. This difficulty was subsequently met by the use of a green formed of the oxide of chromium, which resisted the action of chemical re-agents. A geometrical pattern in this color was printed first all over the paper, and the value, denomination, &c., of the note subsequently printed upon that in the usual way with black ink. This was an effectual check to ordinary photographic imitation, but it would be little or no check to the photolithographer, whose art would furnish him with means of evading this difficulty. A variety of means might be suggested of making the imitation difficult, but they would require more consideration than we can now give to the subject.

We may remark, before concluding, for the information of those of our readers who may be tempted to amuse themselves with experiments in this direction, that the pastime is a dangerous one; as the attempt to copy one of these notes by any process whatever, and for any purpose, is a felony, the consequences of which might be awkward.

FLAX IN IRELAND.—It was supposed that the loss of the cotton crop would lead to a large extension of the growth of flax this year in Ireland. It appears, however, from the returns issued by the *Irish Registrar General*, that the total increase has been only to the extent of nineteen hundred acres. In the south and west of Ireland the cultivation of flax has actually decreased since last year.

Ox Teams and Horse Teams.

The *Massachusetts Plowman* has been making a comparative estimate of the value of horses and oxen. We extract as follows :—

It is generally agreed that horses travel faster than oxen, and that on a farm consisting of plains and destitute of rocks, a pair of horses will do more on the plow and harrow than a pair of oxen. Horses will wear longer than oxen; that is, farm horses will last to work till twenty years old, but oxen should not be kept half so long, though some work till they are fourteen. But after admitting so much, we may be allowed to say a word or two in favor of the practice of keeping oxen. And first, as to the cost of the animals. Oxen of equal weight with the horses are bought for one half price. Oxen are worth something after they are worn out in work—horses are not. Oxen are not half so liable to disease as horses are. An insurer will ask four fold more for insuring the health of horses than of oxen. The gearing for oxen costs less by half than that of horses. A wooden yoke lasts longer than leather harness, and it is put on and off in half the time. One chain answers for two oxen, but two horses must have four. Oxen are more patient than horses, and will carry a more even yoke. They start a load better than horses, particularly in a snow path, where the runners stick to the snow. Oxen can be entrusted with hired men at less risk than horses. They are soon taught to draw the plow, and are driven by the plowman without any reins. We have not a large proportion of farms without rocks and stumps, and where the land is rocky there is no comparison between oxen and horses. In regard to cost of keeping, there would be but little difference if both were kept on the same food. But many of our farmers keep oxen through the winter on coarse hay, straw and husks, which would not keep horses alive. Our own oxen (half-blood Devon) never have any but cheap hay, husks, &c., through the winter, though they labor much of the time. When April comes they are kept on good hay, and they learn the difference between cheap and costly living. Oxen of the right breed are very readily fattened, and their beef is better than that of cows or young cattle, and brings more in the market.

New Method of Preparing Phosphorus.

M. Cari-Montraud gives the following new method of preparing phosphorus in the *Moniteur Scientifique* :—

Taking advantage of the long-established fact of the decomposition at a high temperature of dry phosphate of lime mixed with carbon by hydrochloric acid, M. Cari Montraud founds upon this reaction a new process for the preparation of phosphorus.

Calcined bones finely powdered are mixed with sufficient pulverized wood charcoal to convert all the oxygen of the tribasic phosphate of lime into oxide of carbon. The mixture is put into fire-proof earthen cylinders, glazed inside, which are three parts filled. These cylinders being made red-hot, a current of hydrochloric gas is passed in at one of the extremities. Under these circumstances the phosphate of lime decomposes immediately. Chloride of calcium, oxide of carbon, hydrogen and free phosphorus are formed. The phosphorus is distilled, and is conducted, together with the oxide of carbon, the hydrogen and the excess of hydrochloric gas, by means of a copper adapter, into a vessel filled with cold water, where the phosphorus vapors are condensed. The water of this refrigerating condenser, becoming very acid by the absorption of the excess of hydrochloric gas, is utilized by putting into it the calcined bones, where they are dissolved or softened, rendering pulverization unnecessary.

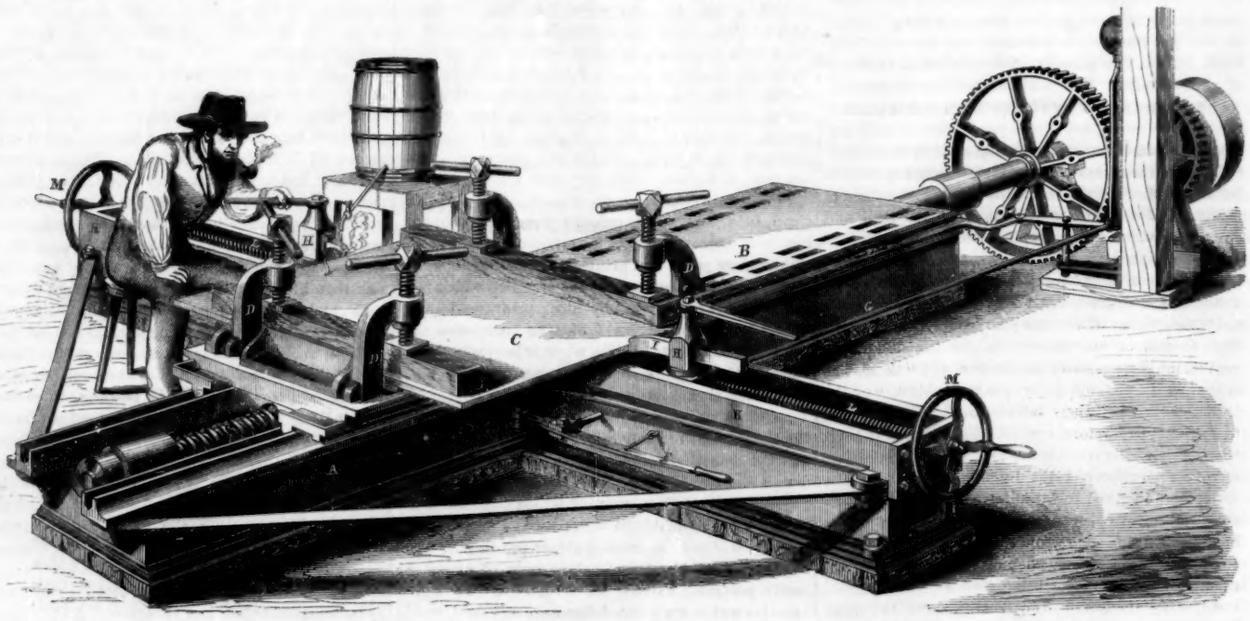
The magma resulting from this maceration is mixed with carbon, and the whole evaporated to dryness before being put into the cylinders.

Hydrochloric gas is produced by the decomposition of sea-salt by sulphuric acid. The chloride of calcium forming the residuum in the cylinders can also be utilized by treating it with sulphuric acid, which regenerates the hydrochloric gas, whilst the lime is converted into sulphate of lime, which is useful for manure. Chloride of calcium can also be decomposed by aqueous vapor.

From January 1st, 1862, to 31st August, 393,232 tuns of Scotch pig iron were exported.

Improved Double Planer for Armor and Turret Plates.

The large number of armor-clad vessels now being built for our navy have created a demand for improved machinery to prepare the plates required for their sides, decks and turrets. Some of these plates are put on straight, but most of them to suit the varying curves of the hull and the turrets. The machinery therefore for planing their edges accurately, and to any required bevel, should be adjustable and of a superior character. And combined with its principles of execution to make the edges of the plates match together and form close joints, the machine should operate with unusual rapidity to perform its work so as to meet the exigencies of the



ROWLAND'S DOUBLE PLANER FOR ARMOR AND TURRET PLATES.

times in providing a powerful armor-clad fleet at the earliest possible date. Such a machine is represented in the annexed engraving. The machine is now in constant use at the Continental Iron Works, at Greenpoint, planing the edges of the plates for the armor-clad turret steamships which are constructing for our navy. It is the largest line iron planer that we have seen in operation; its table is 16 feet in length, and it is capable of planing plates 11 by 9 feet in size. The plates used are one inch in thickness are rolled, and all have rough edges which require to be planed to match both the vertical and longitudinal seams.

This planer, as shown in the illustration, has a heavy iron bed, A, placed upon the floor of the shop. The table, B, upon which the plates to be planed are secured, travels back and forth, and the planing tools are fastened in adjustable rests at each side. Being thus a double planer, it is capable of planing either one, or two edges of a plate at one forward motion of the table. C, represents a plate with one of its edges being planed. It is fastened on the table by the screw clamps, D D D D, and the table is moved back and forth in the usual way by the screw shaft, S, working in a hollow nut in the under side of the table. The forward and reverse motion of table, B, are managed through a clutch arrangement with the wheel and pinion gearing shown at the further end of the machine. The return motion of the table is faster than the forward motion when the tools are cutting. A loose pulley on the driving shaft throws the table shaft out of gear, when required, by shifting the driving belt. F is the lever of the belt shipper and G is the connecting rod. There is a shipper lever at each side of the machine, and both are conveniently located to be operated by the attending mechanics. H H are the two tool stocks. Each holds a planing tool, I, which is bent to act upon the plate during the forward motion of the table as represented. A stream of cold water trickles down upon the edge of the cutter to keep it cool; still there is such an amount of heat generated by the cutting action, that a small cloud of steam is constantly ascending at the point of contact between the tool and face is used, and it is set to cut the exact bevel required. The plates are measured and the lines accurately chalked out so that each is cut according to the width required, and with its proper edge for being fitted into its appropriate place. Some plates need a considerable amount of metal planed off, others a small amount. An idea of the power of this planer may be derived from the fact that the iron shavings taken off are about one eighth of an inch in thickness, and the plates are run through at the rate of 17 feet per minute.

Turret plates are planed with a slight bend for matching in their respective circles. The inside diameter of the new turrets is 21 feet, outside 22 feet 10 inches; thickness 11 inches. Eleven courses of one-inch plates, 20 in a course, are used; thus making 220 plates in one turret. The plates for turrets are 9 feet long by 40 inches wide; the armor plates are five feet square. As the efficiency of our armor-clad vessels depends so much upon the quality of the metal of which the plates are made, we can aver to the toughness and great strength of some plates which we saw tested under the chisel and the hammer. The plates are bent while hot with powerful screw pressers. We were informed that flaws are more liable to be detected by the hot than the cold method of bending.

The turrets for the two iron-clads building at Chester, Pa., and the one at Wilmington, Del., have been built by Mr. Rowland, besides those which are intended for the vessels of his own construction. Of the five for which he has contracted, the *Passaic* was launched some time since; she is now at the dock with her turret on, and she will soon be ready for her trial trip. When the plates of the turrets are drawn up by the through bolts, their joints are as close as a piece of matched joiner work. The *Montauk* was launched on the 9th inst., the *Kaatskill* will soon be ready for launching, and the frame of the *Onondaga* is up. She is a much larger vessel than either of the other three. The keel of the *Puritan*, the last of the five, will soon be laid down. She is to be 340 in length, will carry two turrets and be a most formidable war steamer. The hulls of these vessels under the water-line are as beautiful in their lines as those of our river steamers, and the plating appears to be put on as well as the plates of the famous Clyde-built merchant steamers which come to this port. Plates usually undergo four different preparatory operations. They are passed between iron pressure rollers to straighten them, they are punched for the bolt holes, bent to their proper curvature and planed. Great care, skill and unremitting attention are required to prepare them properly, and fit them accurately into their respective places. The Continental Iron Works at the present time resemble an enormous beehive. A very large force is employed, and the vessels building are being hurried forward with all possible dispatch.

The patent for the improvement on this planer has just been issued, to T. F. Rowland, through the agency of this office. For more information address T. F. Rowland, at the Continental Iron Works, Greenpoint, L. I.

A Wonderful Invention.

In the Zollverein Department of the International Exhibition has just been placed a wonderful piece of mechanism, only a few days from Hanover. All our readers know the difficulty of awakening early in order to catch a morning train. Here is a piece of mechanism which will not only ring a gentle alarum to rouse light sleepers, but it will at the same time strike a light for a lamp, and another to boil a cup of coffee. If the first alarum be not enough, a louder one will follow sufficiently sonorous to awaken the dead. If even this should prove insufficient, the mechanism will, after a short interval, pull off the night-cap, if the sleeper wears one; and in the almost impossible case of a continued slumber after all this, the machine, as if disgusted at such laziness, will tilt the sleeper out on the floor. In fact, the mechanism does everything almost but shout the hour in the sleeper's ear. An extraordinary amount of ingenuity has been expended upon this combination of clockwork, and springs, and lucifers, and levers.

[We copy the above from one of our foreign exchanges. This invention is no touch to one made and patented in this country, and illustrated on page 32, Vol. XI (old series) Scientific American. Instead of going through the process of coaxing and cajoling the sleeper to arouse, the Yankee invention referred to by one operation tips the sleeper out of bed, thus avoiding all the useless and complicated details specified above. The Zollverein invention, however, is the more polite one of the two, and is, no doubt, better adapted to operate on persons of nervous tendencies.—Eds.

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PAPER MONEY AS A GOVERNMENT RESOURCE.

By the census statistics of 1860 the aggregate property in the United States amounted to sixteen thousand millions of dollars. The bank notes in circulation amounted to two hundred and seven millions, and considering that in the Pacific States the currency has hitherto been exclusively metallic, there may have been enough specie in circulation to make the whole money of the country three hundred millions of dollars, which is less than two per cent of the whole property of the community.

A portion of the sixteen thousand millions of property belonging to the citizens of the country consisted of gunpowder, flour, beef, &c., and of this the Government wanted one thousand millions of dollars' worth to carry on the war. How was the Government to obtain possession of this property?

A portion of it the Government was able to borrow, promising to return an equal value at some future time. There were numerous individuals in the community who had property which they could not use to advantage, and they were willing to loan it to the Government. This property existed mostly in the form of merchandise, but it was not for the most part in the kind of merchandise which the Government wanted, so the exchange was effected like other exchanges of property, through the medium of money. The holders of the property sold it for money and loaned the money to the Government, and then the Government exchanged the money for the merchandise which it needed. The only office which the money performed was to effect the exchange of the commodities. Pieces of green paper and little disks of gold and silver are of no more service in battle than pebble stones. War cannot be carried on by means of money unless the money can be exchanged for the needed commodities.

A second mode in which the Government could obtain a portion of the property of the citizens was by taxation—simply seizing it by means of the physical force which was under the direction of the authorities.

The third plan adopted was the issuing of notes of the Government, designed to circulate as money; it being supposed that any persons who owned gunpowder, horses, or any other property which the Government wanted, would willingly give their property in exchange for these notes. What was the effect of this measure?

As payment was refused by the banks on the two hundred milions of their notes, and as the Government did not redeem its notes, the two circulated together, swelling the amount of our currency. This led to a general advance in prices. Every thing which the Government now buys it must pay 33 per cent—the present premium on specie—more for than it would if the currency had not been disturbed. As the other loans to the Government are also being paid in this depreciated currency, while they will be repaid in coin, the whole accruing debt is swollen to the same extent. The debt is contracted with one measure of value to be repaid with another, and the change is against the Government. This issue of small notes, making them a legal tender, is in fact a forced loan, and of all modes of obtaining the property of the citizen, it is the most costly to the Government, and one of the most disastrous to the people. It operates in precisely the same manner as a debasement of the coin—a measure repeatedly adopted by feeble tyrants and which has always proved exceedingly injurious wherever it has been tried. The money belonging to any community forms a very small part of the total property of the community, but it is an exceedingly important part. It is the measure of all values and the basis of all contracts. No other act can introduce so general confusion into the industrial operations of a community as an alteration of the value of the currency. This act impairs the obligations of all contracts and overthrows all prospective calculations.

The experience of France with the issue of *assignats*, that of James II. with his brass guineas, that of this country with its continental currency, and that of many other nations have demonstrated that, when the currency has been depreciated beyond a certain limit, it will be refused in the exchange of commodities, and will cease to perform its office.

Desiring the suppression of the rebellion and the salvation of the country as warmly as the safety of our own lives, we yet warn the Administration to devise other means for obtaining the property which it needs than the unlimited issue of "green-back" notes.

LUPINE AND CROOKED BEAM PLOWS.

On another page will be found the article contributed by Louis Schade to the Patent Office Report for 1861, on the Lupine plant. It will be seen that this plant is cultivated mainly for enriching land by plowing in the green crop, and it is possible that some of our readers may like to know what kind of plow is best for turning in the green crops.

Some years since, the writer of this had sixty acres of timothy meadow in Illinois ruined by army worms, and pig weeds sprung up over the whole field. In the fall it was determined to plow these weeds in, and a crooked beam plow was constructed for the purpose. To make the beam of sufficient strength, it was desirable to have the natural crook of the wood, and to obtain this an oak tree was dug around, and a portion of the root cut off with the trunk. In this way a beam was obtained so crooked that when made into the plow the highest part stood nearly three feet above the ground.

Three horses abreast were attached to this plow, and a man was set to work plowing in the weeds. So wonderful is the fertility of the Western prairies, that, though the statement may seem incredible, it is a fact, when these three horses with their driver had started in among the weeds, they were as completely hidden from sight as if they had marched into a forest.

But these tall, thick weeds were rolled under by the high beam plow without the slightest difficulty, and the whole field was smoothly and handsomely plowed.

MORE ABOUT COTTON AND ITS SUBSTITUTES.

The English mind seems to be in such a state of excitement respecting a deficiency of cotton that it grasps eagerly at every proposed substitute for it. A few weeks since some beautiful samples of prepared jute were exhibited in Manchester, and it was asserted they could be spun on cotton machinery, when lo! the price of jute advanced in a few days fifty per cent. Two weeks ago we pointed out the natural defects of jute, and from foreign papers received since then, we learn that English cotton manufacturers have become convinced that it cannot be used as a substitute for cotton. But the jute excitement was no sooner quieted than another substitute for cotton was brought before the Manchester manufacturers in the form of a very beautiful fiber obtained from the *zostera marina*. This fibrous material was prepared by Mr. Henry Harben, who at a late meeting of the Manchester Chamber of Commerce, exhibited several samples of the article, and described the plant from which they were obtained. It was admitted that the fiber greatly resembled cotton, and that it could be carded and spun on cotton machinery.

The plant which produced the fiber is the well-known *alva*, which is largely used by upholsterers for stuffing mattresses and cheap cushions; coarse paper is also manufactured from it both in America and Europe. It is a flowering marine plant and grows with its root in the sea-water. We judge that it cannot take the place of cotton as a substitute, because it contains a large amount of vegetable gluten, which must be separated by fermenting and washing, thus involving fully more expense than flax to prepare. The great advantage which cotton has over all the substitutes proposed is that it can be prepared for carding by simple ginning, whereas jute, flax and the *zostera marina* require to be treated by both chemical and mechanical processes.

A contributor to the Manchester *Examiner and Times* asserts that there is more cotton in Liverpool than has been reported, and that the exact quantity has been underrated for speculative purposes. From his statement we would conclude that the stoppage of so many of the English cotton factories was due to a want of demand for manufactured goods rather than a deficiency of cotton. His statement may not be reliable, but he says there are now 170,000 bales in Liverpool, and that in the course of the present year there will arrive from India 450,000 bales; from Egypt 40,000; from Brazils 55,000; from Greece 10,500; Italy 12,500; Malta 5,000; America 5,000; Turkey 50,000; making a total of 798,000 bales. The quantity of American cotton is under-estimated we believe. More cotton has been received at New York lately than most persons are aware of. Exclusive of the cotton taken by our cruisers, no less than 15,066 bales were received during the four weeks ending the 11th inst. A considerable quantity of this came from the southwest by railroad. At present the prices in New York are 57 and 57½ cents per lb., for midlings, which is higher than it has been for half a century.

MALACHITE AND WORKS OF ART.

If copper were as unoxydizable when exposed to the atmosphere as gold or silver, it would be esteemed one of the most beautiful as it is one of the most useful metals. When polished, it is of a deep reddish color, but it soon becomes dull, owing to a portion of its surface combining chemically with the oxygen of the moist atmosphere, and forming a thin greenish coating. This green oxide is copper rust. Some of the ores of copper are exceedingly beautiful, especially the green and blue carbonates, the former called "malachite." It usually accompanies the ores of copper, but it has been found in the largest masses, and greatest abundance in certain mines in Siberia; and Russia is the only country which has attained distinction for the manufacture of articles from it. Sir Roderick Murchison, the eminent geologist, who has examined the Russian mines, supposes that this carbonate of copper was once in a liquid state, and that it gradually solidified by slow dropping. Every mass of it seems to have been grouped around a center, in nearly concentric layers, and according to the varying richness of the solution at different periods during dropping, the concentric layers varying in dark and light tints of beautiful green. The masses of malachite found in the Siberian mines are generally of a rounded form. This mineral is softer than marble, but it is much heavier; quite brilliant, and its green tints have a silky appearance. It has been held to be a gem by some writers, and it almost deserves to be classed among the precious stones of the jeweler. It is fragile and very difficult to work. Although seldom found in lumps wieghing more than twenty pounds; masses have been found in the Ural mountains, in the mines of M. M. Demidoff, of St. Petersburg, in masses of several tuns weight. It receives a very high polish, and is chiefly used in the production of rich inlaid cabinet work, such as tables, mantel pieces, work boxes, snuff boxes, vases. In several of the palaces of the emperor of Russia, there are rooms in which the furniture is mostly veneered with malachite.

At the celebrated Malachite Works of M. M. Demidoff, in St. Petersburg, the largest pieces of malachite are first reduced to blocks, then they are cut into thin veneers, with circular saws. A block of malachite being secured upon its carriage, it is fed toward a revolving circular disk, and fine sand and water are fed into the cut until the veneer is severed, in the same manner that marble slabs are cut out. In every piece of malachite, there are light and dark streaks of green, and their curves are as graceful as some of those in veneers cut from mahogany crotches. These veneers of malachite are cut to the proper form, so as to combine the varying tints in

the most artistic and agreeable manner. Every piece has its edges cut with a revolving copper disk, then the edges are ground to fit them accurately for the positions they are to occupy. In a table, the framework of which is iron, the malachite veneers are set in their proper situations, with a cement made of malachite dust. When all the pieces are laid according to the prepared design, they are then ground down with sand, and finally polished with rouge. No seams can be detected in the work, and the play of the light green tints is really beautiful. Some of the churches in St. Petersburgh have columns of veneered malachites. It requires great patience to work in this material, as it is so liable to break. The greatest artistic work in malachite ever executed was by M. M. Demidoff, in the form of a set of folding doors for a grand saloon. They were seven feet wide and fourteen feet high, the veneering was about one-fourth of an inch in thickness, and thirty men were employed a whole year in their construction. Very beautiful specimens of this mineral have been obtained at the copper mines, Cheshire, Conn., at Morgantown, Penn., and at New Brunswick, N. J.

THE PRICE OF COAL AND BURNING OF FUEL.

The present high price of coal has given rise to much complaint in this community. It is very commonly believed that speculation has much to do with this; and on this account an irritable state of feeling exists against coal companies. They, on the other hand, state that the rise in price of coal is caused by a scarcity of supply, owing to breaks during summer in some of the Pennsylvania canals, thus preventing the usual quantity reaching the Eastern markets. We learn from the *Ledger* that there is a scarcity of coal in Philadelphia, and the following statement is presented respecting the rates and periods of the advances in prices:—

"For Lehigh Prepared Coal the prices have ruled as follows:—June 7th, $5 ₱ tun of 2,000 lbs.; June 10th, $5 50; September 1st, $6, and October 8th, $6 50. For the long tun of 2,240 lbs. of Lehigh Stove Coal the price is now $7 25, and it is the belief of those in the trade that it will go to $8 before the end of the present month. These are high figures compared with last year, and indeed with the opening prices this season."

We learn from the same source that although the quantity of coal forwarded by the leading coal companies in Pennsylvania is not so great as it was last year, still it is not so much less as to cause such a rise in its price. Thus, up to the 4th of October last, the quantity carried by the eleven leading roads was 5,632,843 tuns, against 5,838,208 for the same period last year. This decrease in quantity affords some grounds for a slight rise in price; and, combined with this, there has also been a rise in miners' wages, a large increased demand for steamship fuel, and a depreciation in the common currency. But, whatever may be the causes for the rise in the price of coal, we know that declamation will not reduce it. Under such circumstances the voice of reason suggests the employment of the most improved modes and appliances for burning the coal and distributing the heat, so as to reduce the quantity of fuel used. We do not refer to any particular stove or heater, or mode of heating. There are a variety of such before the public, and some of them very excellent. We only exhort all those who use coal not to employ a bad system while coal is so high in price, when a new and improved apparatus may save more than its cost in economizing fuel.

A great deal of fuel may also be economized in burning it properly. In many cases one half the heat that can be derived from coal is never developed, owing to a neglect in applying scientific information respecting the chemistry of combustion. To this point we desire to direct special attention. Combustion or burning of anthracite coal consists in oxygen combining chemically with the carbon of the coal at a high temperature. The chemical action generates the heat. Now, there are two kinds of combustion—perfect and imperfect. The latter is produced when only one atom of oxygen unites with one atom of carbon. In such a case a bluish flame is seen above the fire, and the product is carbonic oxide. Perfect combustion consists in the chemical union, at a high temperature, of two atoms of oxygen with one of carbon. In such a case an intense white heat is exhibited in the fire, and the product is carbonic acid.

Only one half the heat that may be obtained from coal is developed by imperfect combustion, consequently there is a waste of one half of the fuel. This is owing to a deficient supply of air to the fire. In perfect combustion, on the other hand, all the heat that can be obtained from the fuel is developed. An immense waste of coal in stoves and furnaces is caused by practising imperfect modes of burning the fuel. If possible, every furnace and stove should be so constructed and arranged that perfect combustion may be secured, by a sufficient supply of air, which should be heated before it enters the fire.

NATURAL SHAPE OF THE FOOT—HOW BOOTS AND SHOES OUGHT TO BE MADE.

A contributor to *All The Year Round* states that several treatises have lately been published in London by professors of anatomy, especially Dr. Humphrey of the Cambridge University and Dr. Meyers of Zurich, which have been instrumental in instituting a reform in making boots and shoes by the London shoemakers:—

The bootmaker, ignorant of the relative use and importance of the different parts of the foot, has steadily persisted for centuries, and at this day usually persists, in so shaping the shoe that the great toe is forced upon the other toes more or less out of its right line with the heel. Nine civilized people in ten, perhaps, have their great toes thus by a course of submission to misshapen boots and shoes so far turned inward, that a line run down in the middle of them, from point to ball, if continued would not fall anywhere in the heel at all, but several inches away outside the body. The necessary consequence is that the full strength of the natural lever, the toe, for raising the body is destroyed; the effort has to be made at a disadvantage and with pressure, and the act of walking loses some of its grace and much of its ease.

Professor Meyers states that although a shoe may be easy, it is not to be held that it is always made right. The foot may have been distorted by wearing improperly made shoes, and the person may have become accustomed to the bad-shaped shoe. Lasts have usually been made slanting outward at the great toe, and shoes made from such tend to bend the toe out of its proper line. Thus in a foot unwarped from its primitive shape a straight line drawn down the middle of the great toe, from the middle of its tip to the middle of its ball, would, if continued, pass exactly through the middle of the heel. The smaller toes do none of the lifting. They give lateral support, and help in securing a good grip of the ground, especially to those who walk barefoot on difficult ways. The reason why so many persons have enlarged toe joints is because they have been accustomed to wear narrow angular-toed boots and shoes, by which the joints have been thrust out of line in walking.

According to this writer, if a well made pair of boots be placed side by side so that their heels touch, their sides also will touch through the whole space in front of the instep from the place of the ball of the great toe to the very end of it. They will diverge only at the rounded ends, where the great toe rounds off into the little toes, along whose line, and nowhere else, any possible pointing of the shape of the boot sole can be allowed. There is no better rough test of the degree to which a pair of boots has been adapted to a pair of feet, than to place them with their inner sides together, and observe the cut of the soles. The more they diverge from each other between the place of greatest breadth and the end of the toes, the worse they are; the more they tend to be in contact along that line, the better they are; and when they quite touch throughout that line, they are what they ought to be. To secure this, to secure also a sole of which the greatest breadth corresponds truly with the greatest breadth of the tread, and which, moreover, is contrived to allow room enough for the play of the foot in walking, including its lengthening or shortening with the ranging curve of its arch, is to secure what we ought to have, by compelling shoemakers to understand the true history of their trade. There must be no inelastic sole, and no tight lacing to impede the free movement of any of the foot joints. The now prevalent use of a light boot fastened only by the imperceptible pressure of an elastic web let into each side over the ankles, and so slipping easily over the instep, is a change in the right direction.

AN AMERICAN SCULPTOR.

The works of art of the highest class in the London Exhibition are not the productions of Italians, but an American and an English artist—Gibson and Story—take the highest rank. The Cleopatra and Sibyl by Story, our American artist, are held to be the finest specimens of modern sculpture in the Exhibition. A foreign writer says respecting them: "There is about them an antique grandeur, repose and breadth of conception, which throw every other statue in the Roman Court into the shade. Compared with Powers' Greek Slave, which created such a sensation when it was exhibited in 1851, Story's Cleopatra and Sibyl seem to belong to another people and another era. Of the two we prefer the Sibyl; there is to us an intensity of vitality in the brooding mystery of her attitude which we can only compare to the figure of Michael Angelo on the tomb of Lorenzo de Medicis. The whole *pose* and expression of the Sibyl are beyond our power of criticism; we feel but are unable to analyze. The subject of both statues is from the antique, and the treatment in each case is eminently successful."

Mr. Story, if we mistake not, is a son of the celebrated jurist, Joseph Story. We remember to have met with some of his works in Europe in 1855, which gave promise of great success.

A Great National Almanac Forthcoming.

George W. Childs, of Philadelphia, announces that he will publish at the beginning of next year a National Almanac, in the form of a 12 mo. volume of from 300 to 400 pages, containing a vast variety of valuable information, on a great number of subjects, among which are the following:—

The Army: its organization.

The Navy: its organization.

Battles of the World: a chronological list of all the important battles from the earliest times to the present date, with an accurate account of those now taking place in our own country; together with a record of the events of the present war since its commencement, prepared from original sources at Washington.

The Government of the United States: its organization; with a full account of all its departments.

A List of Patents issued during the year in the United States.

Progress of the Sciences during the year—including mechanics, agriculture, chemistry, botany, geology, meteorology, &c.

Ecclesiastical Record and Progress of Religious Denominations at home and abroad.

Foreign Governments: their organization, population, government, &c., with ample statistics and so on.

This almanac promises to be a valuable work of reference.

Letters from the People.

We hope our readers will not forget that we are always happy to receive communications from them upon all such subjects as properly belong to the columns of the Scientific American. Write just as you talk, and give us facts, even if they are not set forth in fine language. We will always take care to put them in proper shape before publication. We want letters from the workshop and the laboratory.

Patents in England.

In the advertising columns our readers will find an advertisement respecting the sale of valuable patents in England. Many of our readers have secured valuable patents in England, but have yet been unable to do anything with them for want of the proper facilities. The party advertising is a reliable English gentleman, and enters energetically and favorably upon his enterprise.

Two establishments in Austria employ six thousand work-people in the manufacture of lucifer matches. The annual production is forty-four millions of matches. One of these concerns is in Vienna, and the other in Bohemia.

WONDERFUL BALLOON ASCENT FOR SCIENTIFIC PURPOSES—GREATEST HIGHT EVER ATTAINED BY MAN.

A few weeks since—page 170—we gave an account of the second balloon ascent made at Wolverhampton, England, by Mr. Glaisher of the Greenwich Observatory and Mr. Coxwell, a distinguished aeronaut, for the purpose of making observations for scientific purposes, as a committee of the Association for the Advancement of Science. Since that period they have made another aerial voyage, making six altogether, three from the Crystal Palace and the same number from Wolverhampton. This last voyage was the most interesting of all, and in some respects the most wonderful ever made, as the daring aeronauts attained to a higher elevation than ever had been reached before by human beings. This last ascent took place on the 5th of September.

Mr. Coxwell was the manager of the aerial machine, and the attention of Mr. Glaisher was devoted to the reading and the registering of his instruments. These consisted of hygrometers, barometers and thermometers;—a 3-feet barometer which had been specially constructed for the voyage, a stereoscopic camera and a set of extremely sensitive dry plates for the purpose of taking a photograph of the appearance of the clouds; and with a view to watch the effect of the upper air on winged life, Mr. Glaisher likewise provided himself with half-a-dozen pigeons, the experiments upon which proved of a most interesting character.

The balloon was capable of containing 90,000 cubic feet of coal gas, but only 60,000 feet were used. It was obtained at the Wolverhampton Gas Works, and the Superintendent made it expressly for the purpose of less specific gravity than was ever before used. This was 0·340, the ordinary burning gas being 0·470. The balloon was set at liberty at 1 P. M., and it rose slowly and majestically, taking a course almost southwest. During the ten minutes or quarter of an hour that it remained in sight the balloon was seen by hundreds of people; but suddenly, at an altitude of about a mile, it became lost in a belt of dark-grey clouds that enshrouded the earth from the fiercer rays of the sun. These clouds Mr. Glaisher states were 2,000 feet thick, and seemed to be saturated with water. As the balloon rose this dampness gradually diminished, and a greater difference became apparent between the dry and wet bulb, and, on reaching their highest altitude, the aeronauts observed no dew whatever. Immediately on passing through the clouds, the scene which presented itself was grand beyond description. The beginning of their journey had been performed in an atmosphere that was darkened and humid; but now they suddenly shot up into an expanse of cloudless, ethereal blue. Below them was the earth resembling a planet. It was like looking on a country whose frozen surface extended as far as the eye could reach; deep crevice and dark ravine contrasted boldly with the lighter and more fleecy clouds that towered aloft and caught the streaming sunshine. Some were white as snow; others black, dark grey and of shapes fantastic. One would rear its lofty head on a baseless stem and throw its neighbors into a shade as black as night; another, like a bald bluff crag, would sail with a majesty becoming its immensity, through minor clouds surrounding it; and a third, more light and delicate, would change its place and hue as often as the voyagers could observe it. Added to this was a strong sunlight, which for a few moments became so intense that Mr. Glaisher had to shade his instruments. When a favorable opportunity presented itself the camera was brought into requisition, but the balloon was ascending with such velocity—owing to the expansion of the gas, and the lighter character of the atmosphere—that Mr. Glaisher failed to obtain a single picture. At three miles high the machine was rising at a fearful pace; the 60,000 feet of gas had expanded to 90,000, and was oozing out of the safety-valve at the bottom of the balloon. Mr. Coxwell, however, fearing that they might be approaching the sea, and having nothing but supposition to judge by, determined to make the best of his time, and though the velocity was such as to give a rotary motion to the balloon, he threw out more ballast and higher and higher rose the voyagers, attaining an altitude where the cold became intense, and where Mr. Coxwell, who, from having undergone great exertion, found the power of breathing extremely difficult and oppressive. By Mr. Glaisher, however, no such unpleasant sensation was experienced—not even the intense cold; he remained in a state of perfect quiet. At one time the balloon was ascending with such rapidity that it created a rush of wind, which the voyagers at first believed to arise from a current of air into which they were just entering. But this was not the case, for the same current prevailed throughout the whole of the journey, and apparently at a uniform speed.

When the aeronauts were at a hight of three miles they threw out the first pigeon and it fell earthward like a lump of lead. A few minutes afterward a second pigeon was thrown out, but, after gallantly attempting to keep itself on the wing, it too, fell far away below the car and out of sight of the aeronauts; the same results were observable in the case of a third pigeon; but a fourth which was set at liberty at a hight of four miles, alighted on the top of the balloon and was lost sight of; what became of it afterward the voyagers are unable to say. The two remaining pigeons were brought to the ground. On examining them one was found to be dead; the other, a carrier, was greatly exhausted, but able to perch on Mr. Glaisher's finger. At a hight of four miles Mr. Coxwell heard faint indications of terrestrial sounds; but Mr. Glaisher observed none after he had reached an altitude of a mile and a half; when at that hight he distinctly heard the report of a gun; the only sound which he perceived afterward was the rushing noise made by the balloon as it sped upward.

When the voyagers had attained an altitude of about five miles Mr. Glaisher began to feel those symptoms that had well nigh proved dangerous to him, but in spite of which he persevered, making observations of importance to science and meteorology. The temperature was below zero, and gradually descending in an atmosphere so thin that the least exertion caused breathing to be a matter of extreme pain and difficulty. Mr. Glaisher subsequently became unconscious without betraying the slightest symptoms of uneasiness, or producing any such effects on his companion. Mr. Coxwell's power of endurance seemed almost wonderful, for, notwithstanding his exertion, climbing in and out of the rigging, lifting the sand-bags and discharging nearly 2,000 pounds of ballast, he was able to withstand the effects of the atmosphere, and to save himself and his companion from being swept into eternity. At the hight of about five miles Mr. Glaisher entered his last ascending register, recording the temperature at minus 5°, being a temperature about 97° below that at the earth's surface. Mr. Glaisher then found that his eyesight began to fail, and he asked Mr. Coxwell to assist him in reading the instruments. Mr. Coxwell however, was wanted in the rigging to arrange some of the cordage, and seeing that their lives were more important than the discoveries of science, he at once got into the rigging of the balloon to attend to his own particular duties. Mr. Glaisher in the meantime was using his spectacles and magnifying glasses, but he could ascertain nothing except that the barometer stood at about 10 inches, which would indicate a hight of 5¼ miles. He had previously felt himself gradually becoming unconscious, and had made an entry to that effect in his minute-book; but when he attempted to enter the registering of the barometer he found that he could not write. Thinking a little stimulant would revive him he reached out his hand to a brandy-flask that was not more than a foot from where he sat, but he discovered he was powerless and gradually he became unconscious; the last object that he saw was the dim outline of Mr. Coxwell's figure in the rigging of the balloon. Directly after this Mr. Coxwell observed the condition of his companion. He states that Mr. Glaisher was leaning back on his seat, his feet outstretched, his mouth open, his arms by his side, but his countenance perfectly calm. He descended into the car and tried to revive him but could not, and Mr. Coxwell was also beginning to feel symptoms of faintness, and fearing that he, too, might become unconscious—for the balloon was still rapidly ascending—he began to make preparations for lowering the machine. On attempting to seize the valve-string he found that he had lost the use of his hands, and that they were perfectly black. Fortunately, being a dentist as well as an aeronaut, and believing in the power of his teeth, he seized the cord with his mouth, and after a desperate pull he opened the valve, and the balloon began to make its descent. In the course of a few minutes Mr. Glaisher revived, and by the time that he reached the earth the effects of his faintness had entirely disappeared. While Mr. Glaisher was unconscious Mr. Coxwell happened to cast his eyes on the needle of the aneroid barometer, and when Mr. Glaisher recovered he informed him of its position. From this observation Mr. Glaisher estimates that they attained a hight of fully six miles. At a hight of five miles the mercury stood at minus 5°; the self-registering thermometer indicated that it had been as low as minus 20° or 52° below freezing point. Among the articles taken up in the balloon was a quantity of water, and until they reached a hight of five miles Mr. Glaisher kept it from freezing by occasionally stirring it with a small ladle. When he recovered his consciousness he found that the water had been frozen into a solid block of ice, and it remained in this condition for more than an hour and a half after he reached the earth. Ozone was observable in the upper atmosphere. The atmosphere beyond the clouds was extremely dry, and but for this circumstance the cold would have been felt much more intensely.

The descent was made at 3·20 P. M., in a field twenty-eight miles from Wolverhampton. They telegraphed the result of their journey to Wolverhampton, and the next day returned to that place and started for London. Mr. Glaisher states that each voyage had its own particular feature, and considers that before the British Association can secure the object it seeks, it will be necessary to make observations at all seasons of the year, and he believes also, that the most interesting of those observations will be obtained at a hight of about four miles.

In one respect the balloon ascent seems pretty conclusive as to the hight at which it is possible for animal life to exist. Had it not been for the presence of mind of Mr. Coxwell the voyagers would have shot up into an atmosphere so thin that respiration could not be sustained, and in the end the expansion of gas would have probably burst the balloon; or, if the safety-valve had been sufficiently large to allow for that expansion, they might have been carried into space and numbered among the victims on the altar of science. Such a fate, though, was not in store for them; a guiding Providence allowed them to descend in safety.

The ascents of Gay-Lussac and others for scientific purposes sink into comparative insignificance with the half-a-dozen voyages that have been made by Mr. Coxwell and Mr. Glaisher. Gay-Lussac attained an elevation of over four miles. In the first ascent from Wolverhampton Mr. Coxwell and Mr. Glaisher reached an elevation of four miles 1,685 yards; second ascent from Wolverhampton, four miles 700 yards; third ascent from Wolverhamptom, six miles. The same gentlemen, from the Crystal Palace, have reached altitudes of three miles 200 yards, one mile 667 yards, and one mile 504 yards.

Emigration to America.

A circular has been addressed by the Government at Washington to the diplomatic and consular officers of the United States in foreign countries. "At no former period of our history," says this document, "have our agricultural, manufacturing, or mining interests been more prosperous than at this juncture. This fact may be deemed surprising in view of the enhanced price of labor occasioned by the demand for the rank and file of the armies of the United States. It may therefore be confidently asserted that, even now, nowhere else can the industrious laboring man and artizan expect so liberal a recompense for his services as in the United States. You are authorized and directed to make these truths known in any quarter, and in any way which may lead to the migration of such persons to this country. It is believed that a knowledge of them will alone suffice to cause them to be acted upon. The Government has no legal authority to offer any pecuniary inducement to the advent of industrious foreigners.

Sweet apples contain a large amount of sugar or saccharine matter in their composition, and are therefore nutritious and good to feed cattle, horses, pigs, sheep and poultry.

The London Exhibition—Wrought-Metal Decorative Work.

The following is condensed from our cotemporary *Newton's London Journal of Arts and Sciences;* it will be of great interest to our workers in wrought iron :—

In no branch of manufacture is progress more evident than in wrought-metal work. But lately it was an art revived in England solely with the view of providing suitable fittings for the Palace of Westminster, and already it has become an extensive trade.

The specimen in this class which, both from its imposing size and beauty of design, first arrests attention on entering the building, at the eastern dome, and looking down the south transept, is the wrought-iron rood screen of the Skidmore Art Manufactures Company, of Coventry, designed by Mr. G. G. Scott, R. A., and constructed for the choir of Hereford Cathedral. It is composed of five pointed arches; the middle one, which rises higher than the others, being surmounted by a gable, which carries a cross at its apex. The heads of the arches are filled with tracery, and they are divided by a central twisted pillar of brass, the lower part of the side arches being also filled with panels formed of wrought iron foliated scroll work. In an oval division of the tracery of the central arch is a bronze figure of our Saviour, and on either side, supported on corbels, is a group of figures. At the ends of the screen there are also figures similarly supported. The main pillars are in part incased in burnished brass, which metal is so judiciously distributed over the whole structure as to produce a charming effect. The whole of the iron work is painted in low-toned tints of red, green, brown, and purple, obtained from oxides of that metal.

At the entrance of Messrs. J. Hardman and Co.'s court, is a pair of wrought iron gates, unpainted, and showing exquisite workmanship, in which the duplication of foliage is riveted to solid backing. Exception may, perhaps, be taken to the quality of this design, which is somewhat stiff, and of an elongated, upright character; but the manner of carrying it out gives evidence of a practiced hand, conversant with those rules, a departure from which invariably detracts from the artistic effect of the best work. A pair of rood-screen gates, exhibited by Messrs. Benham and Sons, although not happy in design, deserve notice as good hammered work, wrought apparently with careful attention to the rule we desire to enforce.

Perhaps there is no practice which has served so effectually to debase ornamental cast work as the piling together of separate castings to produce ornaments, which are thus made attachable and detachable at pleasure. With stove and fender manufacturers this has been long in vogue, the ornamentation having the same relation to the structure it adorns as the trimmings have to a bonnet. We are very sorry to find this vice making its appearance in wrought work, as showy effects are rapidly obtained thereby; which inducement, if not counteracted, may tend to an indulgence in overlaid ornament. At first view, this objection may appear to be a repetition of what we have already discussed, but it is a much further departure from the true principles of wrought work, which admit of no detachable parts—unity of structure being secured either by welding, which is the best means, or by rivets. In a pair of wrought-iron gates, exhibited by Messrs. Hart & Son, who, as we understand, do not take the responsibility of the design, some circular panels are filled with star-shaped ornaments in copper, which ornaments are composed of overlaid or piled (not laminated) pieces of sheet copper, beaten out respectively to their required shapes, and attached together, and held in place, by means of a screw bolt and nut. These fillings are, therefore, simply detachable ornaments, and may, at any time, be replaced by others equally inappropriate, or removed altogether, without in any way affecting the construction of the gates. This example shows, also, duplicated foliage, embracing and binding structural parts of the gates. The workmanship is very satisfactory. The Skidmore Art Manufactures Company show also another imposing work, in the form of a tomb canopy, which is of elegant design, executed chiefly in iron, and painted in the same peculiar and most successful manner as their rood screen. Altogether, the display of wrought iron is very creditable, and as nothing of the kind, so far as our researches have gone, is to be found in the foreign courts, our manufacturers have the field entirely to themselves.

If, however, the supply of this class of work is ever to equal the desire for its possession, the cost of production must be materially reduced. This can only be effected by the introduction of modern mechanical appliances, which have done so much toward reducing the price of most articles of manufacture. It is manifest that this class of work involves not merely the exercise of artistic skill in carrying out the designs of the architect, but also considerable physical force and tedious manipulation in working the malleable iron into form. Whatever, therefore, is calculated to economize this labor, should be diligently sought out and quickly applied. The first point to be considered is, whether, through the numerous inventions for improving the manufacture of iron, some better material is not available than has heretofore been employed; and the second is, whether the power placed in our hands by the steam hammer (which is constantly receiving extended applications), or other equivalent force, cannot be adapted with advantage to this branch of art manufacture. It is generally believed that the province of stamping dies is to produce with rapidity repetitions of the same forms, and nothing else; and, consequently, it may be inferred that such tools operated by a steam hammer must necessarily debase all artistic work to which they may be applied. So far from this being the case, it is well known that artificial flowers are produced on an exactly similar principle, and without committing ourselves to the commendation of this art, it is enough for our purpose to state that identity or monotony of form in flowers or leaves, howsoever often repeated, is not the vice of the artificial flower manufacture. Dies, therefore, if the draughtsman's art be put into them, will produce artistic basic forms of leaves ready for modeling by the hammer into such graceful curves as may fit them for their destination in the design. During this manipulation, though the typical form will be preserved, an individuality must of necessity be given to each leaf that will distinguish it from all others, and thus a dull uniformity of grace will effectually be avoided.

RECENT FOREIGN INVENTIONS.

Copies of Maps, Charts and Drawings by Photography.—A patent has been taken out by R. A. Brooman, London, being a communication from abroad, for improvements in copying maps, drawings, music and printed charts without injuring the originals. The object of the invention is to copy the prints on stone and print from it any number of impressions. The stone is first prepared in a dark room with a varnish composed of gums and the bichromate of potash, and when it has become dry the picture or chart to be copied is placed upon its face downwards. On the top of this a sheet of glass is laid which keeps the design in contact with the stone, and it is then exposed to the light for a time varying from one to fifteen minutes. The stone is then returned to the dark chamber and very gently washed with white wine to remove the soluble parts of the varnish. All those parts of the varnish which have been preserved from the action of the light by the dark lines of the design are soluble and are removed by the wine washing. The stone is again washed with pure water to remove all traces of the wine. The design is now upon the stone—the copying of the chart, map or whatever it may be, has been effected without injury to the original. Those parts of the stone which have not the design upon them are now covered with varnish and dried, after which some soap-suds are poured over its surface and it is dried again. It is now moistened with soft water and the stone is inked with transfer ink slightly accidulated with acetous acid. Only those parts of the stone not covered with varnish take on the ink which is allowed to dry. The whole of the varnish is now removed with white wine, when the design is left in black upon the stone and the ground white. The stone is now left to dry for twenty-four hours, when it can be employed to take a great number of impressions by the usual method of lithographic printing.

Basis of Artificial Teeth.—A composition to form the basis of artificial teeth has been proposed by M. & A. Gabriel, London. It is composed of india-rubber, 7 parts; sulphur, 2; phosphate of lime, 2½; and phosphate of soda, 2. The object of the invention is to form a compound which will give a representation of the natural bone, and at the same time resist the action of the acids of the mouth and stomach. While in a plastic state this compound is molded and hardened in the usual way, after which it is polished. It is now placed in an electro-galvanic bath and a thick coating of pure gold deposited upon it.

Peculiar Woven Fabric.—T. & W. & J. Wilkins, of Nottingham, England, have recently patented a new style of woven fabric. The invention consists in a peculiar mode of arranging and lapping the warp threads, whereby fabrics are produced in weaving which have one surface consisting of raised pyramids; the reverse side having corresponding cavities. The warp threads are caused to lap in such a manner that the fabric is divided longitudinally and transversely, so that the woven product consists of a series of square sections which assume the shape of pyramids on the one side and similar depressions on the other when taken out of the loom. Different colored warp threads are used, so as to produce ornamental pyramids, the apex of some being blue, others green, &c.

Gas from Petroleum.—A patent has been taken out by L. Davis and F. M. Parks, Esq., for producing gas for general illumination from petroleum at a very low temperature; its destructive distillation to obtain incondensible gas has been considered a difficult undertaking. These patentees employ a double vertical retort, so that the petroleum may be subjected to a very high temperature at two rapidly succeeding intervals. The gas so made is obtained from unrefined petroleum, and it is capable of being stored away in a gasometer and distributed like coal gas.

Whitworth's Projectiles.—An improved mode of manufacturing projectiles has been patented by M. Whitworth. As the shot used for the Whitworth guns are egg-shaped, the improved mode of making such consists in placing each in a chuck made for the purpose, whereby both the front and rear ends are turned simultaneously without taking it from the chuck. The projectile is held in the chuck by the middle part, and the chuck is made to revolve while the tools turn the ends by being moved in slide rests. The lubricating material is applied to these projectiles in spiral strips.

Bessemer & Co., of Sheffield, England, assert that they manufacture, by what is called the "Bessemer Process," soft steel which possesses all the toughness of the best malleable iron, is of double strength, homogeneous and free from cracks. Plates for boilers are made of this metal, also carriage axles, piston rods, &c.

RECENT AMERICAN INVENTIONS.

Blind Fastener.—The object of this invention is to obtain a fastening for window shutters and blinds which will admit of being applied with far greater facility than those hitherto constructed, and without injuring or weakening the shutter or blind, and when applied be much better protected from the weather and not so liable to get out of repair as the ordinary fastenings hitherto used. To effect these results the invention consists in having the catch or fastenings fitted in a metallic case which is simply inserted in a hole bored in the shutter or blind, thereby saving the time and labor of mortising, and using a spring attachment applied in such a manner as to exert a pressure against the shutter or blind, and effectually prevent it from rattling. The same end is attained by another invention, which consists in having a stud or pin and a projection, which are attached respectively to the window sill and to the side of the building and on which the catch of the blind or shutter fits, of taper or wedge shape in their horizontal section, and having the recesses in the catch of corresponding taper form, so that when the latter catches on the former it will fit snugly thereto and effect the desired result. Both of these devices are patented by W. B. Barnard, of Waterbury, Conn.

Machine for Planing Iron.—This invention is more especially designed for planing the edges or sides of metal armor plates for war vessels and is intended to facilitate, in a great degree, the finishing or jointing of said plates and in a more perfect manner than hitherto. To this end the invention consists in the employment or use of a sliding or reciprocating bed on which the plates are placed or secured, in connection with two cutters attached to the framing of

the machine, one at each side of the bed, and arranged in such relation with the plate thereon, that, as the bed and plate are fed or moved along, the cutters will act upon the edges or sides of the latter and plane both of them simultaneously. T. F. Rowland, of Greenpoint, N. Y., is the inventor of this improvement.

Governor for Steam Engines—This invention relates to the attachment of the balls or centrifugal weights of the governor to springs, one of the two extremities of each of which is made fast relatively to the spindle, and the other relatively to the slide or sleeve of the governor. In governors of this kind, as heretofore constructed, the springs have been so arranged that they have been of elliptical or semi-elliptical form when the governor has been at rest, and have tended to assume a circular or semi-circular form when the governor was set in motion with an increasing velocity, or else they have been of nearly circular form when at rest, and have tended to assume an elliptical form when the governor was in motion. Now, in a centrifugal governor, it is a desideratum to have the weight of the centrifugally moving parts collected as much as possible in two or more points, that is to say, practically speaking, in the balls. It is, therefore, desirable to have the springs to which the balls are attached as light as possible, but with springs of the above-mentioned form, sufficient strength to produce the necessary centripetal force to act in opposition to the centrifugal force of the balls, or sufficient stiffness to counteract the effects of gravitation upon the balls when the governor is in an inclined or horizontal position, cannot be obtained without making the springs somewhat heavy. The object of this invention is to enable the requisite centripetal force and stiffness to be obtained with a lighter spring, and to this end it consists principally in so constructing and applying the springs that the ends and those portions passing through the balls, may be parallel, or thereabout, with the axis of the governor in all its positions and conditions, by which the springs are caused, when subject to the centrifugal action of the balls, to have on each side of their balls a cyma form. It also consists in a certain mode of securing the balls to the springs, and in a certain mode of securing the ends of the springs to the spindle and slide of the governor, whereby the springs are enabled to be retained in the above-mentioned condition under all variations in the plane of revolution of the balls. Thomas R. Pickering, of New York city, is the inventor of this device.

Windmill.—This invention consists in the arrangement of a spider, connected by suitable rods with the lowest slats or shutters of each sail, in combination with spring slat bars attached to the rear side of the several shutters, in such a manner that, by the action of the spider and slat bars, the several shutters are combined so that by opening one the rest are also opened, and at the same time the slat bars are so attached to the shutters that the centrifugal force of said bars causes the shutters to open whenever the velocity of the wheel exceeds a certain point, and that said bars thus assist in governing the speed of the wheel. It consists further in combining with the shutters of each sail an adjustable vane, in such a manner that if a sudden gust of wind strikes the wheel, or if the force of the wind exceeds a certain limit, the shutters are thrown open by the action of the wind on said vanes, and damage to the wheel is prevented. It consists, finally, in the arrangement of a serrated disk attached to the solid shaft which carries the spider, in combination with one or more teeth projecting from the side of the bevel wheel on the hollow shaft which carries the wind wheel, and with spring pads and suitable levers, in such a manner that by the action of said levers, serrated disk and spring pads, the slats can be opened at any moment and kept open by the action of the teeth projecting from the bevel wheel, and thereby the motion of the windmill can be stopped whenever desired. This improvement is the invention of Henry Glover, of Oxford, Mass.

Nail Machine.—The improvements in this machine are more especially applicable in connection with the use of a double set of cutters and heading devices, and of a feeder which operates in combination therewith, to provide for the cutting of the nails with a proper degree of taper without turning over the plate, but some of them are or may be applicable with equal advantage in machines which have but a single set of cutting and heading apparatus, and which turn over the plate between the successive cutting operations. The said improvements were invented by G. B. Wiggin and John W. Hoard, of Providence, R. I., and relate to the heading apparatus and to the feeder.

ISSUED FROM THE UNITED STATES PATENT OFFICE

FOR THE WEEK ENDING OCTOBER 30, 1862.

Reported Officially for the Scientific American.

*** Pamphlets giving full particulars of the mode of applying for patents, under the new law which went into force March 2, 1861, specifying size of model required, and much other information useful to inventors, may be had gratis by addressing MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, New York.

36,595.—G. W. Ansley, of Cleveland, Ohio, for Improvement in Skates :

I claim the herein described special arrangement of the cavity, A', case, B, and springs, K K', when these parts are constructed with the pivoted shank, C, loop, F, and adjusting screw, I, as and for the purpose specified.

36,596.—W. B. Barnard, of Waterbury, Conn., for Improvement in Window-Blind Fastenings :

I claim the employment or use, in connection with a shutter or blind fastening, of a pressure rod applied either to the window sill or to the shutter or blind, to operate as and for the purpose herein set forth.

35,597.—W. B. Barnard, of Waterbury, Conn., for Improvement in Blind and Shutter Fastenings :

I claim the wedge-shaped stud or pin, E, in the sill, D, of the window frame, and the wedge-shaped lip, e, on the projection, F, attached to the building, in combination with the spring catch, B, provided with the taper recesses, d, substantially as and for the purposes herein set forth.

36,598.—Charles Bassett, of Massilon, Ohio, for Improvement in Hoisting Cranes :

I claim the disk, D, and friction balls, E, in combination with the revolving arm, H, when the several parts are constructed and arranged substantially as and for the purpose herein specified.

36,599.—H. Biebuyck, of Brussels, Belgium, for Improved Blasting Powder :

I claim the use in the manufacture of blasting powder of nitrate of baryta, whether combined with nitrate of potash or not, substantially as herein set forth.

36,600.—Charles Boeckh, of Strausburg, France, for Improved Cleaner for Lamp Chimneys :

I claim a brush or rubber for cleaning lamp chimneys, the shaft of which being adapted only to one side of the inner portion of the chimney and being covered with some rubbing or brushing material, the brush not being round shape like the common chimney cleaners in use at the present time.

36,601.—S. S. Campbell and Josiah Goodwin, of Philadelphia, Pa., for Improved Machine for Making Confectionery :

We claim the method herein described for filling the boards with starch or any substance that the impressions can be made in from a stationary box or hopper, while the boards are passing under, and for smoothing or leveling the starch or any substance that the boards may be filled with by means of a stationary strike or smoother, while the boards are in motion, and for molding or making the impressions in starch, sugar, flour or any composition that can be used in the molding or making the impressions, by means of a lever and springs, and for the running, dropping or filling the impressions with any mixture or composition making or called confectionery or candy, that requires to be run or dropped in the way described, by means of two plates, one working on or over the other, each plate being perforated with holes, the top plate working by means of a piston or rod, opening and closing the apertures, and for filling all the impressions at one and the same time.

36,602.—John Carton, of Utica, N. Y., for Improvement in Railroad Lamps :

I claim the outer tube, E, the cup thereof forming the chamber, H, and the bottom, B, all constructed and operating substantially as described, in combination.

36,603.—William Clissold, of Dudbridge Works, Stroud, England, for Improvement in Machinery for Oiling Wool. Patented in England Feb. 24, 1862 :

I claim the oiling of wool, preparatory to carding the same, by means of a pressure roller supplied with the oil or oleaginous mixture by a traveling brush which receives the same from a dipping plate or its equivalent, as above described.

36,604.—Russell Cobb, of Hadley, Mich., for Improved Hay and Grain Rack :

I claim the box, A, in combination with the platform, B, and folding frames, C C, all constructed and arranged substantially as shown, to form a new and improved hay and grain rack for vehicles, as set forth.

[This invention relates to an improved hay and grain rack designed to be placed on wagons in order to facilitate the loading of the same and to form a proper base to receive the load so that a requisite amount can be placed on the wagon and properly adjusted or disposed thereon ; the invention, at the same time, preventing the waste of grain when the latter article is being loaded on a wagon, and also insuring the hay or grain being retained or held in proper position.]

36,605.—C. E. Easton, of Cedarville, N. Y., for Improvement in Fences :

I claim the combination of the stakes and the riders, with the panels inclined laterally in opposite directions, as described, when the parts are constructed and arranged in reference to each other, substantially as set forth, that is to say, the stakes being independent of, or not attached to the panels forming the lower part of the fence, and the stakes and riders being so arranged that the latter shall meet over the middle of each panel instead of at the ends, the riders not being attached to the stakes, but pressing by their weight into the angle between them, to bind the stakes and thereby the fence in position.

36,606.—John Du Bois, of Williamsport, Pa., for Improved Mode of Constructing, Setting and Removing Bridges:

I claim, first, A floating foundation adapted in form and construction and operation substantially as described, to the purposes herein set forth.

Second, The combination of the piles, a a, and their attachments, c, with the floating foundation, so that the side frames of the bridge may be adjusted to a vertical position, substantially as set forth.

Third, The method substantially as herein described of constructing, setting, removing and replacing a span of a bridge.

36,607.—G. W. Ellis and C. W. Glidden, of Stoneham, Mass., for Improved Machine for Attaching Heels to Boots and Shoes and Polishing the Same :

We claim, first, The perforated plate, T, having a shank or neck, w, fitted to work up and down in the tube, O, which terminates at its lower end in a plate, S, provided with rods, r, the perforated plate being forced downward to hold the heel of the shoe or boot firmly upon its last by a helical spring within the tube, in combination with the last or bed, I, sliding tube, G, rods, k, and cam, H, when arranged for joint operation in the manner and for the purpose described.

Second, The slotted lever, Q, fitted upon the tube, O, and having a hinged knife, R, attached to its outer end by a shank or neck, s, fitted to work in a curved slot, q, in the plate, P, when the whole is combined and arranged to operate in the manner described.

Third, The burnishing frame, V, in connection with the plate, P, arranged substantially as set forth.

Fourth, The strap or guard, I', attached to the last, I, at its back part, when used in combination with the rods, k', for the purpose specified.

Fifth, The clamp, M, attached to the slide, L, in connection with the plate, N, or its equivalent, when arranged to operate in connection with the knife, R, substantially as and for the purpose specified.

Sixth, The cutter, d', provided with a gage, e', attached to the adjustable arm, U, which is connected to the plate, s, as and for the purpose herein set forth.

[The object of this invention is to obtain a machine which will admit of the work set forth in the title being done in an expeditious and perfect manner, so as to effect a great saving in labor and produce a better article than hitherto. The invention consists in the employment or use of peg-driving devices, knives, a burnishing device and a clamp, all arranged to effect the desired end.]

36,608.—J. P. Gage and J. C. Gilbert, of New York City, for Improvement in Utilizing the Products of the Asparagus Plant :

We claim the within described preparation, new commodity, or article of manufacture, substantially in the manner and for the purpose set forth.

36,609.—R. R. Gaskill, of Wyanet, Ill., for Improvement in Cultivators :

I claim, first, The plow bars, F F, secured to the front cross bar, h, of the frame, A, by means of the double hinges or universal joints, a^2 a^2, in combination with the rods, G G, fitted in the bearings, H, connected to the bars, F F, and arranged with the adjustable bearings, J', as shown to operate as and for the purpose specified.

Second, The adjustable or moveable seat, C, when arranged as shown and used in combination with the bars, F F, rods, G G, and levers, J or E, as and for the purpose set forth.

Third, The swinging or adjustable draught hole, D, arranged as shown with the holding lever, E, in combination with the brakes formed of the levers, O, rods, Q, and cranks, R, with the shoes, S, attached, all arranged to operate as and for the purpose set forth.

[The object of this invention is to obtain a cultivator, having its plows arranged in such a manner that they may be readily adjusted to plow to a greater or less depth, and at a greater or less distance apart as may be required, and at the same time be capable of being manipulated by the operator, either while riding on the machine or walking behind it.]

36,610.—Henry Glover, of Oxford, Mass., for Improvement in Wind Wheels :

I claim, first, The arrangement of the spider, L, rods, k, and shutters, K, in combination with the spring slat bars, h', connecting the several shutters of each sail, and secured to the rear side of said shutters, substantially as and for the purpose described.

Second, The arrangement of the adjustable vanes, M', in combination with the shutters, K, of the wind sails, J J, constructed and operating in the manner and for the purpose specified.

Third, The arrangement of the serrated disk, N, sliding shaft, M, projections, n, and spring pads, t, in combination with the spider, L, and shutters, K, of the wind sails, J J, constructed and operating substantially as and for the purpose set forth.

36,611.—Alexander Gorden, of Rochester, N. Y., assignor to James Brayley and John B. Pitt, of Buffalo, N. Y., for Improvement in Grain Separators :

I claim, in combination with a straw belt or raddle, having a shake motion communicated to it, a rack or series of slats, placed within the straw belt, for the purpose of preventing the straw from working through, and getting back into the machine, but without preventing the grains from going through, substantially as described and represented.

36,612.—J. F. Griffen, of New York City, for Improvement in Fruit Jars :

I claim a jar top, that is composed of one or more arms, c, extending to or beyond the center of the cover, C, and of a ring, D, with inclined planes, b, the whole combined as shown and described.

[This invention consists in a jar top, composed of one or more spring arms extending from a ring, provided with inclined planes to or beyond the center, in combination with lugs projecting from the neck of the jar, in such a manner that on applying the inclined planes of the ring to said lugs, and turning it in the proper direction, the spring arm or arms bear down upon the cover of the jar with a yielding pressure, and a tight joint is produced without the danger of breaking or injuring the jar or cover.]

36,613.—James Hageman, of Williamsburg, Ohio, for Improvement in Buckets and Measures :

I claim the wooden bottom when bound around the edge with metal, and attached to the body of the bucket or measure, in the manner and for the purpose set forth.

36,614.—R. W. Hale, of Boston, Mass., for Improvement in Feed-Water Heating Apparatus :

I claim the method herein described of heating the feed water of steam engines, by means of an exhaust steam pipe, and a surrounding water pipe, combined and operating in the manner set forth for the purpose specified.

36,615.—J. Hodskinson and O. C. Smith, of Salem, Mass., for Improved Washing and Wringing Machine :

I claim the reciprocating rubber, E, in combination with the endless apron, H, and rollers, I J L and O, arranged in connection with the frame, A and F, to operate as and for the purpose herein set forth.

[This invention consists in the employment of an endless apron, pressure rollers and a reciprocating rubber, arranged in such a manner that the clothes may be subjected to a requisite degree of rubbing, in order to cleanse them thoroughly from dirt, and then be subjected to a sufficient pressure between rollers, so as to have the moisture expelled from them, the washing and wringing operations being performed consecutively, and by a continuous operation of the machine.

36,616.—D. W. G. Humphrey, of Chelsea, Mass., for Improved Button-Hole Stitch :

I claim the button-hole or edge-finished stitch, made from two threads and interlooped, substantially as described.

36,617.—D. W. G. Humphrey, of Chelsea, Mass., for Improvement in Sewing Machines :

I claim, first, The needle-bar carrier, C, operated as described, whereby a regular lateral motion is imparted to needle, a, carrying it alternately through and over the edge of the material worked upon, to form an edge-finish or button-hole stitch.

Second, The combination of the needle bar carrier, C, the loop carrier, d, needle, b, hook, c, and loop check, i, with needle, a, arranged and operated as described, whereby the button hole stitch represented is produced.

Third, The cam wheel, We, employed to feed the material to be stitched, when such material is held and directed by or acted upon through plates, clamps or their equivalents, the said cam wheel being moved by any suitable mechanism.

Fourth, The slotted plate, V, for the purpose of giving direction to the feed clamp in stitching any form of button hole, in combination with the cam wheel, We, for the purpose of moving the said feed clamp, both arranged and operating substantially as specified.

Fifth, The feed clamp, K2, constructed substantially as described, for the purpose of holding the material to be worked upon, while it is being fed and directed by the cam wheel, We, in combination with the slotted plate, V, or by any other suitable mechanism.

Sixth, The employment of the rocker, X, piston, c2, adjustable plate, Y3, and spring, r2, in combination with the lever, T, operated as and for the purpose specified,

36,618.—Clarence Linden, of Eden Township, Ill., for Improved Atmospheric Air Bed and Knapsack:

I claim, as a new article of manufacture, the elastic air bed, constructed so as to be carried and used as a knapsack when constructed and its parts, relatively to each other, all arranged as and for the purpose specified.

36,619.—Joseph Marks and Richard Eaton, of Hamilton, Canada, for Improved Spark Arrester:

We claim, first, The perforated or gauze cones, B B and C C, in combination with the outer shell of the smoke stack, when the former is arranged within the latter, as described.

Second, The double cone piece, D, arranged in the lower open end of the perforated or gauze cone, B B, so as to deflect a portion of the sparks which escape through the perforations or meshes of the cone, B B, through an annular space at the bottom thereof, into and against the inner sides of the chimney or smoke stack, substantially as described.

[This invention consists, first, in the use of two or more conical diaphragms of gauze, wire netting or perforated plates, held at a convenient distance from each other in the smoke stack. Second, in the employment of a central double cone piece, whereby the sparks which escape through the diaphragm or perforated cone are allowed to return into the chimney, and by the action of the exhaust steam are farther reduced in size, and extinguished before being finally ejected into the atmosphere.]

36,620.—J. G. Perry, of South Kingston, R. I., for Improvement in Pocket Knives:

I claim the combination of the bolt with the escutcheon or name piece, substantially as described and for the purpose set forth.

36,621.—T. R. Pickering, of New York City, for Improved Centrifugal Governors:

I claim the employment of the collar, E, with the spring ends, and the flanch, B, as and for the purpose herein shown and described.

Second, The combination of the leaves, g h, with the spring, D, as and for the purpose herein shown and described.

Third, The employment of the central plugs, e e, in combination with the balls, F, and springs, D, in the manner and for the purpose herein shown and described.

36,622.—Elias Rhoades, Sen., of Clyde, Ohio, for Improvement in Pumps:

I claim the disk valves, D, perforated heads, B, and ledges, a, in combination with the hollow piston rod, G, and valves, m, and openings, o, when these several parts are constructed, arranged and operated in connection with the cylinder, A, as and for the purpose specified.

36,623.—H. C. Sergeant, of New York City, for Improvement in Steam Pumps:

I claim the arrangement of the steam and pump cylinders, balance wheel shaft, cranks and connecting rods, as specified in the foregoing specification.

36,624.—T. F. Rowland, of Green Point, N. Y., for Improvement in Machines for Planing Metals:

I claim fitting the cutters, C, within the uprights, b, in the manner herein shown and described.

36,625.—F. S. Robinson, of Boston, Mass., for Improvement in Machines for Separating Cotton Waste:

I claim the combination of the supporting bar, D, one or more series, F F G, of teeth (applied to a rotary carrier as specified), and mechanism by which each range of teeth shall be caused, during the revolution of the carrier, to seize the waste as it may project from the bar, D, and draw it out therefrom, and separate it more or less, and subsequently let go of it in manner substantially as hereinbefore explained.

36,626.—S. H. Sugett, of Eden, Maine, for Instrument for Reaming Out the Barrels of Ships' Pumps:

I claim the reaming instrument, with its cutter, i, chamber, b, and movable plate, a, the whole being arranged substantially as set forth, for the purpose specified.

36,627.—J. E. Thomson, of Buffalo, N. Y., for Improvement in Apparatus for the Manufacture of Illuminating Gas:

I claim a compound retort, D D', containing three chambers, f g h, constructed, arranged and used (either vertically or horizontally), for the purposes and substantially as herein set forth.

36,628.—G. I. Washburn, of Worcester, Mass., for Improvement in Annealing Iron and Steel Wire, &c.:

I claim, in the process of annealing wire or other articles, the use of such an artificial atmosphere or gas, or mixture of gases, in the annealing pot or vessel, as will enable me to control the degree of oxidation of the iron or steel being annealed, or to prevent oxidation entirely, substantially in the manner herein described.

36,629.—G. B. Wiggin and J. W. Hoard, of Providence, R. I., for Improvement in Nail Machines:

I claim, first, The combination of the heading die levers, O O*, stirrups, j j*, and toggles, k k*, with the oscillating cutter head, F, in the manner herein shown and described.

Second, So applying the heading dies, N N*, in the form of plungers, that they may be free to turn on their axes, substantially as and for the purpose herein specified.

Third, The employment for drawing back the heading dies, N N*, of hooks, l l*, attached to the heading levers, O O*, and arranged to operate substantially as described upon flanges n n*, provided on the said dies, for the purpose of turning them.

Fourth, The arrangement of the single pair of nippers, D D', to operate in combination with the two sets of holding dies, substantially as herein specified.

Fifth, Supporting the whole of the feeder in a carriage, R S, composed of a transversely-moving slide, R, and a standard, S, pivoted to the said slide, substantially as herein specified.

Sixth, The opening of the tongs by means of two pins, v v, arranged to operate substantially as herein set forth.

Seventh, So applying the guides, T, T, in combination with the carriage of the feeder as to permit them to be raised up high enough to allow the feeder to be turned away from the cutters, substantially as and for the purpose herein specified.

36,630.—Luman Andrews (assignor to himself and Phineas Stevens), of De Kalb, Ill., for Improvement in Telegraph Cables:

I claim, in combination with the cylinder, A, and the valves, B B', the sliding joint, m n, in the cable, a, constructed and operating substantially as set forth.

Second, I claim the arrangement of the cylinder, A, the movable rings, C C', and wires, b b, in combination with the sliding joint, m n, operating as described.

36,631.—Edwin Blackman (assignor to himself and J. S. Taylor), of Danbury, Conn., for Improvement in Self-Weighing Carts:

I claim the steel yard, E, and platform, J, in combination with steel yard, F, and prop, D, (or spring scales suspended from the cattle), when constructed and applied to a cart, substantially in the manner and for the purposes hereinbefore set forth.

36,632.—A. H. Perkins (assignor to himself and J. M. May), of Janesville, Wis., for Improved Process of Treating Coal Tar to Manufacture Roofing Cement:

I claim the new process herein described of treating coal tar, to form a cement material, for the purposes set forth.

36,633.—G. L. Witsil (assignor to himself and Thomas Cochran), of Philadelphia, Pa., for Improved Apparatus for Stirring and Mixing:

I claim two or more spiral rods or bars, contained in a vessel of suitable form, one spiral rod being left handed and the other right handed, or the rods being otherwise so arranged, and caused to so revolve, as to produce separate currents in, and a thorough agitation and admixture of, the contents of the vessel, in the manner specified.

RE-ISSUE.

1,335.—Charles Perley, of New York City, for Improvement in Compound Capstans for Ships:

I claim, first, A removable heaver on a vertical shaft, sustained and rotated from below said heaver, in combination with a second shaft and capstan or capstan head, and with gearing between the said shafts, substantially as and for the purposes specified.

Second, I claim a capstan on a vertical shaft, that can be connected to or disconnected from the shaft, in combination with a chain wheel or heaver on a separate vertical shaft, the two shafts being connected by gearing, substantially as set forth; whereby the capstan can be used separately from the heaver, or both heaver and capstan can be rotated in either direction, to take in or give out chain cable, as set forth.

Third, I claim the adjustable bearing block, o, in combination with the chain heaver, m, to relieve the vertical shaft of said heaver from strain and friction that would otherwise result from the weight of the chain, or the strain on the same while the vessel is lying at anchor, as set forth.

Fourth, I claim the combination of the power capstan, n, coupling, 9, and heaver, m, for the purposes and as specified.

PATENTS FOR SEVENTEEN YEARS.

The new Patent Laws enacted by Congress on the 2d of March, 1861, are now in full force, and prove to be of great benefit to all parties who are concerned in new inventions.

The duration of patents granted under the new act is prolonged to SEVENTEEN years, and the government fee required on filing an application for a patent is reduced from $30 down to $15. Other changes in the fees are also made as follows:—

On filing each Caveat	$10
On filing each application for a Patent, except for a design	$15
On issuing each original Patent	$20
On appeal to Commissioner of Patents	$20
On application for Re-issue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing Disclaimer	$10
On filing application for Design, three and a half years	$10
On filing application for Design, seven years	$15
On filing application for Design, fourteen years	$30

The law abolishes discrimination in fees required of foreigners, excepting reference to such countries as discriminate against citizens of the United States—thus allowing Austrian, French, Belgian, English, Russian, Spanish, and all other foreigners except the Canadians, to enjoy all the privileges of our patent system (except in cases of designs) on the above terms.

During the last sixteen years, the business of procuring Patents for new inventions in the United States and all foreign countries has been conducted by Messrs. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN; and as an evidence of the confidence reposed in our Agency by the Inventors throughout the country, we would state that we have acted as agents for more than FIFTEEN THOUSAND Inventors! In fact, the publishers of this paper have become identified with the whole brotherhood of Inventors and Patentees at home and abroad. Thousands of Inventors for whom we have taken out Patents have addressed to us most flattering testimonials for the services we have rendered them, and the wealth which has inured to the Inventors whose Patents were secured through this Office, and afterward illustrated in the SCIENTIFIC AMERICAN, would amount to many millions of dollars! We would state that we never had a more efficient corps of Draughtsmen and Specification Writers than are employed at present in our extensive Offices, and we are prepared to attend to Patent business of all kinds in the quickest time and on the most liberal terms.

The Examination of Inventions.

Persons having conceived an idea which they think may be patentable, are advised to make a sketch or model of their invention, and submit it to us, with a full description, for advice. The points of novelty are carefully examined, and a reply written corresponding with the facts, free of charge. Address MUNN & CO., No. 37 Park-row, New York.

Preliminary Examinations at the Patent Office.

The advice we render gratuitously upon examining an invention does not extend to a search at the Patent Office, to see if a like invention has been presented there, but is an opinion based upon what knowledge we may acquire of a similar invention from the records in our Home Office. But for a fee of $5, accompanied with a model or drawing and description, we have a special search made at the United States Patent Office, and a report setting forth the prospects of obtaining a Patent &c., made up and mailed to the Inventor, with a pamphlet, giving instructions for further proceedings. These preliminary examinations are made through our Branch Office, corner of F and Seventh-streets, Washington, by experienced and competent persons. More than 5,000 such examinations have been made through this office during the past three years. Address MUNN & CO., No. 37 Park-row, N. Y.

How to Make an Application for a Patent.

Every applicant for a Patent must furnish a model of his invention if susceptible of one; or if the invention is a chemical production, he must furnish samples of the ingredients of which his composition consists, for the Patent Office. These should be securely packed, the inventor's name marked on them, and sent, with the government fees by express. The express charge should be prepaid. Small models from a distance can often be sent cheaper by mail. The safest way to remit money is by draft on New York, payable to the order of Munn & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents; but, if not convenient to do so, there is but little risk in sending bank bills by mail, having the letter registered by the postmaster. Address MUNN & Co., No. 37 Park-row, New York.

Caveats.

Persons desiring to file a Caveat can have the papers prepared in the shortest time by sending a sketch and description of the invention. The government fee for a Caveat, under the new law, is $10. A pamphlet of advice regarding applications for Patents and Caveats, in English and German, furnished gratis on application by mail. Address MUNN & CO., No. 37 Park-row, New York.

Foreign Patents.

We are very extensively engaged in the preparation and securing of Patents in the various European countries. For the transaction of this business, we have offices at Nos. 66 Chancery Lane, London; 29 Boulevard St. Martin, Paris; and 26 Rue des Eperonniers, Brussels. We think we can safely say that THREE-FOURTHS of all the European Patents secured to American citizens are procured through our Agency.

Inventors will do well to bear in mind that the English law does not limit the issue of Patents to Inventors. Any one can take out a Patent there.

Circulars of information concerning the proper course to be pursued in obtaining Patents in foreign countries through our Agency, the requirements of different Patent Offices, &c., may be had gratis upon application at our principal office, No. 37 Park-row, New York, or either of our Branch Offices.

Notes and Queries

H. T., of Pa.—Borax is a salt composed of boracic acid and soda and is also called borate of soda. It is manufactured upon an extensive scale from the boracic acid of certain warm lagoons in Tuscany, by adding to the acid carbonate of soda. The acid arises in vapor from the hot lagoon and it is condensed by being conducted through cold water. Borax is used extensively as a flux in metallurgical operations, also in the processes of welding steel and iron. It is called an alkaline salt because it is more alkaline than acidulous in its action. So far as we know all the borax used in our country is imported from Europe. Formerly considerable quantities of borax came from Thibet.

D. B., of Ind.—The assignee of a part of an original patent would have no right to any part of an improvement subsequently made and patented, unless there was an agreement made that he should enjoy equally a right as under the original patent.

J. J., of Utah.—Your endless chain of cups for well windlasses is not new. We cannot state what the cost of the same would be per running foot,

N. F. D., of C. W.—Brass cannot be prevented from tarnishing in the open air unless it is coated with some varnish. A transparent varnish made with Canadian balsam dissolved in turpentine will answer. White gum shell-lac dissolved in alcohol and colored with turmeric is used as a lacquer for light brass work. Professor Bartlett's "Philosophy of Mechanics," published by A. S. Barnes & Co., this city, is the most comprehensive work published here on the subject.

W. L. C., of Iowa.—Water moving at the rate of 5 miles and 2,400 feet—which is nearly 5½ miles—per hour, has a velocity of 8 feet per second, and this is the velocity that it acquires in falling one foot. Thirty-three thousand pounds per minute falling one foot produces 1-horse power. A stream running with a given velocity has the same force that the water would have in falling from a hight sufficient to acquire the same velocity. Hence with a velocity of 5½ miles per hour you will have 1-horse power for every 33,000 pounds, so you will have a horse power for every 323 cubic feet of water which flows in your stream per minute. If your stream is 6 feet deep and flows with a velocity of 480 feet per minute you will have about 5-horse power for every foot in width.

R. W., of Ohio.—To make nitrous oxide or laughing gas take nitrate of ammonia and heat it gently in a flask to a temperature of about 250°, when it exhibits signs of boiling and is decomposed into water and laughing gas. The latter should be collected over warm water or salt brine. Do not permit the temperature of the flask to become too high, or other gases will pass over. The nitrate of ammonia used should be very pure. A small explosion sometimes attends the manufacture of laughing gas, but with the exercise of ordinary discretion you will be able to manufacture it for experimental purposes.

D. L., of Ohio.—The mineral which you have sent us is of no value in a metallurgical sense. It is mostly composed of silica and a small quantity of ferruginous matter.

Money Received

At the Scientific American Office on account of Patent Office business, from Wednesday, October 8, to Wednesday, October 15, 1862.

R. K., of N. Y., $40; G. & M., of N. Y., $22; S. H., of N. Y., $15; P. C., of Ill., $25; J. H. T., of C. T., $15; F. B., of Conn., $25; R. H. W., of N. Y., $15; P. S., of N. Y., $315; C. L. R., of Wis., $25; I. C., Jr., of Ill., $15; A. N. P., of Ill., $15; J. E. S., of Me., $15; J. T. B., of Ill., $25; S. & H., of N. J., $25; T. N., of C. W., $15; N. P., of N. Y., $15; A. J. E., of N. Y., $15; A. J. S., of Cal., $25; M. L. G., of Wis., $15; M. & J., of N. Y., $15; T. & B., of N. Y., $100; G. B. McD., of Ky., $40; W. T. M., of Cal., $10; M. & G., of Ill., $15; W. H. S., of Conn., $15; G. J., of N. Y., $20; C. G., of Pa., $20; N. A. B., of N. Y., $15; T. H., of N. Y., $20; O. S., Jr., of C. E., $20; J. M. & W. C. W., of Iowa, $20; C. M. A., of Pa., $20; N. B. P., of N. Y., $40; P. & L., of Pa., $37; J. W. B., of N. Y., $25; T. R., of N. Y., $20; J. B. R., of N. J., $43; W. H. J., of Ind., $20; N. A. B., of N. Y., $15; I. E., of N. J., $40; H. U., of N. Y., $20; E. B., of Cuba, $40; J. H. S., of N. Y., $40; L. D. B., of N. J., $20; P. & R., of N. Y., $45; J. G. Y., Jr., of N. Y., $70; H. K., of N. Y., $25; B. K., of N. Y., $25; E. V. S., of N. Y., $25; G. H. R., of N. J., $30.

Persons having remitted money to this office will please to examine the above list to see that their initials appear in it, and if they have not received an acknowledgment by mail, and their initials are not to be found in this list, they will please notify us immediately, and inform us the amount, and how it was sent, whether by mail or express.

Specifications and drawings and models belonging to parties with the following initials have been forwarded to the Patent Office from October 8, to Wednesday, October 15, 1862:—

J. H. S., of N. Y.; J. W. B., of N. Y.; W. T. M., of Cal.; G. & M., of N. Y.; E. B., of France; F. B., of Conn.; P. C., of Ill.; A. I. A., of Ill.; C. L. R., of Wis.; G. J., of Me.; T. V., of Cal.; A. J. S., of Cal.; J. T. B., of Ill.; G. H. R., of N. J.; E. V. S., of N. Y.; R. K., of N. Y.; S. & H., of N. J.; H. K., of N. Y.

TO OUR READERS.

RECEIPTS.—When money is paid at the office for subscriptions, a receipt for it will always be given; but when subscribers remit their money by mail, they may consider the arrival of the first paper a bona fide acknowledgment of our reception of their funds.

INVARIABLE RULE.—It is an established rule of this office to stop sending the paper when the time for which it was pre-paid has expired.

PATENT CLAIMS.—Persons desiring the claim of any invention which has been patented within thirty years, can obtain a copy by addressing a note to this office, stating the name of the patentee and date of patent, when known, and inclosing $1 as fee for copying. We can also furnish a sketch of any patented machine issued since 1853, to accompany the claim, on receipt of $2. Address MUNN & CO., Patent Solicitors, No. 37 Park Row, New York.

NEW PAMPHLETS IN GERMAN.—We have just issued a revised edition of our pamphlet of *Instructions to Inventors*, containing a digest of the fees required under the new Patent Law, &c., printed in the German language, which persons can have gratis upon application at this office. Address MUNN & CO.,
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FOOT LATHE WANTED, ABOUT TWELVE INCH swing, with slide rest and chucks, tools, &c. Must be in good order, and prefer one that has been used by an amateur. Address J. H. SMITH, Newburg, N. Y. 1*

ROLLING AND WIRE MILLS, AND WATER POWER, near Peekskill, for sale or to let. Apply to S. E. LYON, No. 16 Wall street, New York. 17 2*

TO MUSKET MANUFACTURERS.—A MACHINE FOR turning and cutting the thread on the breech pin of the Springfield Rifled Musket, just finished and for sale by J. R. BROWN & SHARPE, Providence, R. I. 17 tf

NEW PATENTS.—A GENTLEMAN OF EXPERIENCE is about leaving for England to establish an agency for negotiating patents. Parties desirous of availing themselves of the benefit of such agency are respectfully requested to address A. B., Box 755 New York Post Office. First-class reference. 1*

WANTED.—TWO OR THREE DIE SINKERS TO work on Stencil Tools; a steady job to a good workman. Address W. K. LANPHEAR & CO., Box 1,749, Cincinnati, Ohio. 17 3*

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TO PHOTOGRAPHERS.—IMPROVED PHOTOGRAPHIC Camera, Patented March 25, 1862, by A. B. WILSON (Patentee of the Wheeler and Wilson Sewing Machine), adapted to all photographic work; such as Landscapes, Stereoscopic Views, Carte Visites, Ambrotypes, &c. Can be used by amateurs and others from printed directions. Send for a circular. Address A. B. WILSON, Waterbury, Conn. 16tf

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FULTON'S COMPOUND, FOR CLEANSING STEAM boilers of scale.—This article is powerful to remove scale, and will not injure the boiler. Western agents, WALWORTH, HUBBARD & CO., Chicago, Ill. Sole proprietor, E. H. ASHCROFT, No. 82 Sudbury street, Boston, Mass. 9 tf

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Your obedient servant, J. HOLT.

MESSRS. MUNN & CO.—*Gentlemen:* It gives me much pleasure to say that, during the time of my holding the office of Commissioner of Patents, a very large proportion of the business of inventors before the Patent Office was transacted through your Agency, and that I have ever found you faithful and devoted to the interests of your clients, as well as eminently qualified to perform the duties of Patent Attorneys with skill and accuracy. Very respectfully, WM. D. BISHOP.

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Die Unterzeichneten haben eine Anleitung, die Erfindern das Verhalten angibt, um sich ihre Patente zu sichern, herausgegeben, und verabfolgen solche gratis an dieselben.

Erfinder, welche nicht mit der englischen Sprache bekannt sind, können ihre Mittheilungen in der deutschen Sprache machen. Skizzen von Erfindungen mit kurzen, deutlich geschriebenen Beschreibungen beliebe man zu addressiren an

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COVERING COPPER OR BRASS WITH LEAD.—The following is from a recent number of the *Polytechnisches Centralblatt*:—

By plunging a copper or lead wire in close contact with a bar of tin into alkaline solution of oxide of lead, the wire becomes covered with a layer of lead, while the tin dissolves in the form of an alkaline stannate. M. Haeffely has made use of this reaction to prepare commercial stannate of soda; but the lead is precipitated in a spongy state, whilst immediately on the introduction of a copper wire into the liquid the lead collects on the wire, spreading evenly over it. The layer thus formed adheres sufficiently to allow of the covered copper being made into evaporating apparatus. However, when submitted for some time to the action of heat, the lead becomes detached.

Were it possible to render the layer of lead very adherent and not porous, this process would be of great service in the manufacture of chemical products. In evaporating acid liquids, copper vessels lined with lead could be used instead of leaden vessels, their thickness being inconvenient.

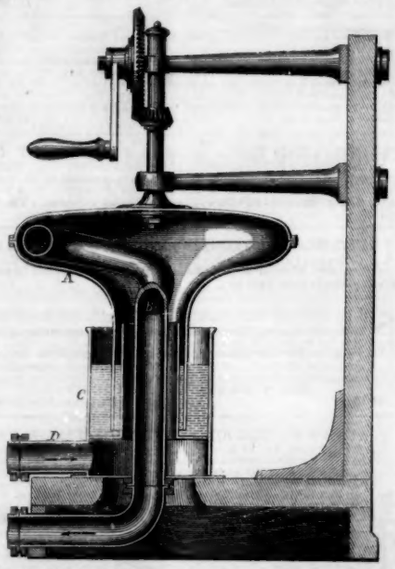
TO MAKE ARTIFICIAL TOURMALINE.—There are several varieties of tourmaline, some of which afford gems of great beauty. Red and green tourmaline have been obtained at Paris, Me., and at Grafton, N. H., crystals of transparent tourmaline are obtained, which Professor B. Silliman, Jr., states may be used in polarizing instruments. This latter species of tourmaline may be made artificially as follows, as described in the *Chemical News*:—

Dissolve 50 grains of bisulphate of quinine in two fluid ounces of acetic acid, and two of proof spirit, warmed to 130° Fah., in a very wide-mouthed flask or glass beaker; then slowly add 50 drops of a mixture of 40 grains of iodine in an ounce of rectified spirit; agitate the mixture and then set it carefully aside for six hours, in an apartment maintained at a temperature of about 50° Fah. The utmost care must be taken to avoid any motion of the vessel; indeed, all accidental vibrations should be guarded against by suspending the vessel by a string, or by allowing it to rest on a mass of cotton wool. If, in six hours, the large laminæ of the salt have not formed, warm the fluid with a spirit lamp, and when it has become clear, add a few drops of the solution of iodine in spirit. The large laminæ form on the top of the fluid, and should be removed carefully by gliding under one of them a circular piece of thin glass. The specimen should be drained by resting the edge of the glass on a piece of bibulous paper, but it must not be touched on account of its extreme fragility; if any small crystals adhere to its surface they must be washed off by pouring over it a few drops of watery solution of iodine. When dry the specimen should be placed for a few minutes under a bell glass by the side of a watch glass containing a few drops of tincture of iodine; and, lastly, a little very fluid Canada balsam should be dropped on it, and a thin glass cover applied without heat. Specimens may thus be obtained of extreme thinness, and half an inch in diameter or even larger, possessing scarcely the slightest color and yet completely polarizing transmitted light.

A NEW PRINCIPLE FOR FANS AND PUMPS.

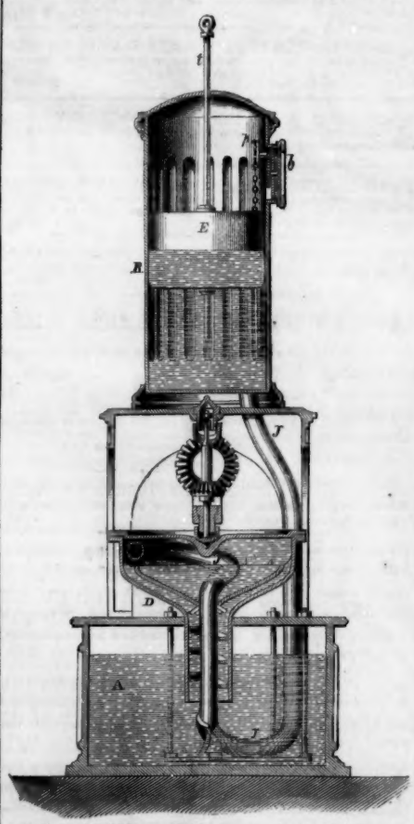
The last number of *Le Génie Industriel* devotes a large portion of its space to describing and illustrating several machines which were sent to the Great Exhibition in London by M. E. Bourdon, *Ingénieur mécanicien à Paris*. These machines, though intended for various purposes, all create currents in fluids by the friction of a revolving body against the fluid. We transfer the illustration of the fan or air pump, this being the simplest application of the principle.

A hollow metallic vase, A, is suspended by a shoulder upon its axle, and is caused to rotate with high velocity. The rubbing of the inner surface against the air in the interior of the vese carries this air around with it. The centrifugal force drives the air toward the outer edge of the vase; causing a condensation and pressure in that part. A stationary tube, B, is introduced from below through the axis of the vase, and curved in semicircular form, with its mouth opening in a direction to catch the revolving current of compressed air, which rushes out through the tube, B, with a velocity depending upon the rapidity of its revolution, and the degree of its compression. The place of the expelled air is supplied by means of a tube, D, the vertical portion of which surrounds the pipe, B, leaving an annular space between. The joint is surrounded by a body of water, C, thus closing it air tight with the minimum of friction.



The friction of the surface of the vase against the imprisoned air may be increased by attaching radial feathers of thin metal to the interior of the walls of the vase.

Our cotemporary says that with a fan 35 inches in diameter, rotating 950 tuns per minute, a pressure is obtained equal to that of 8 inches of water. With a



rotation of 1,900 revolutions per minute the pressure is equal to that of 31 inches of water, which is a little more than a pound to the square inch.

It is easy to see that a rotary pump may be made on the same principle by having the pipes open into water instead of air.

A STEAM ENGINE GOVERNOR ON THIS PRINCIPLE.

One of the most interesting applications which M. Bourdon makes of the principle is the construction of a governor for steam engines. We reproduce also the illustration of this governor.

The rotating vase, D, draws the water from the reservoir, A, and forces it out through the pipe, J, into the vessel, R, where it supports the float, E, resting upon its surface. As the water constantly tends to descend through the pipe, J, by its gravity, but is sustained against the force of gravity by the rotation of the vase, M, it is easy to see that the hight of the surface of the water in the vessel, R, will depend on the rapidity of the rotations of the vase, D. By attaching a rod, *t*, to the float, E, and connecting this rod with a lever which opens and closes the induction valve of the engine, the opening of this valve will be instantly increased if the motion becomes too slow, and will be diminished if the motion becomes too rapid, and thus the speed of the engine will be very accurately regulated.

The float, E, may be connected by a chain to a pulley, *p*, the axle of which carries an index needle traversing before a graduated dial, *b*, by which the opening of the valve will be at all times indicated.

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